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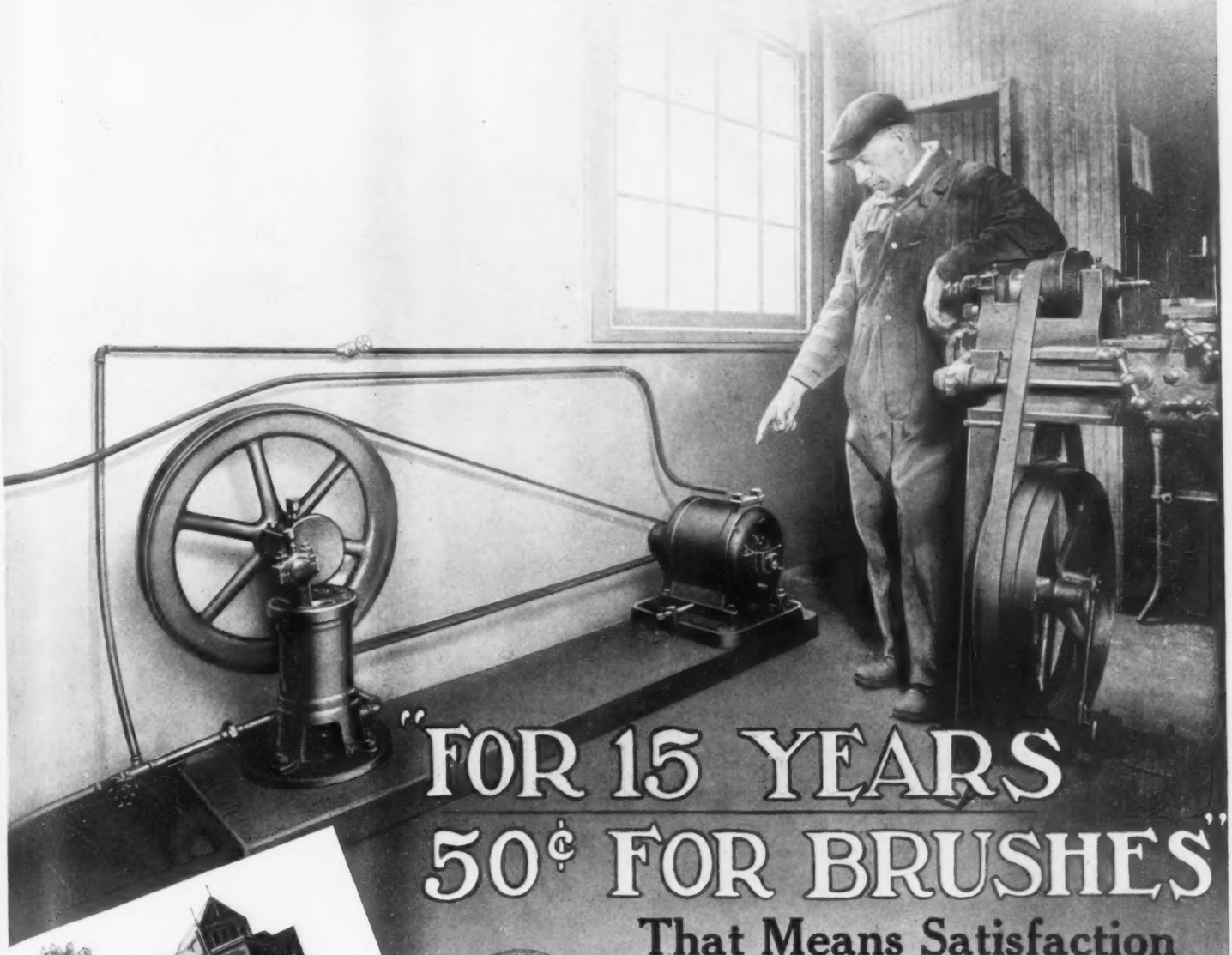

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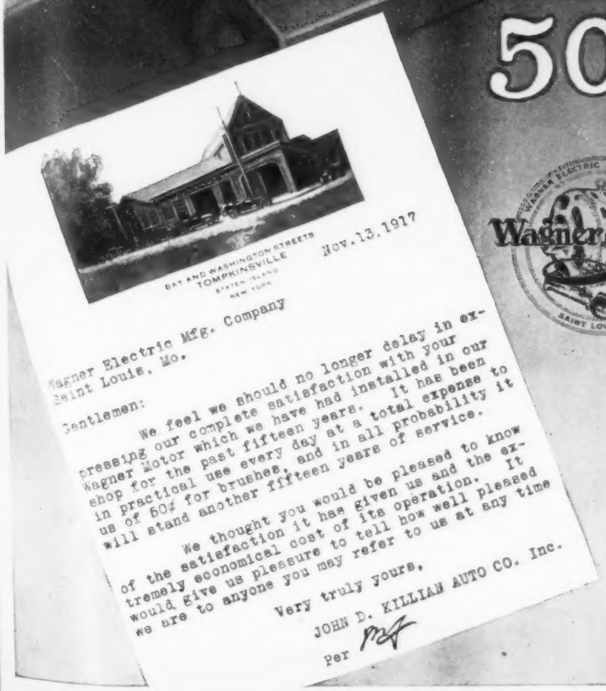

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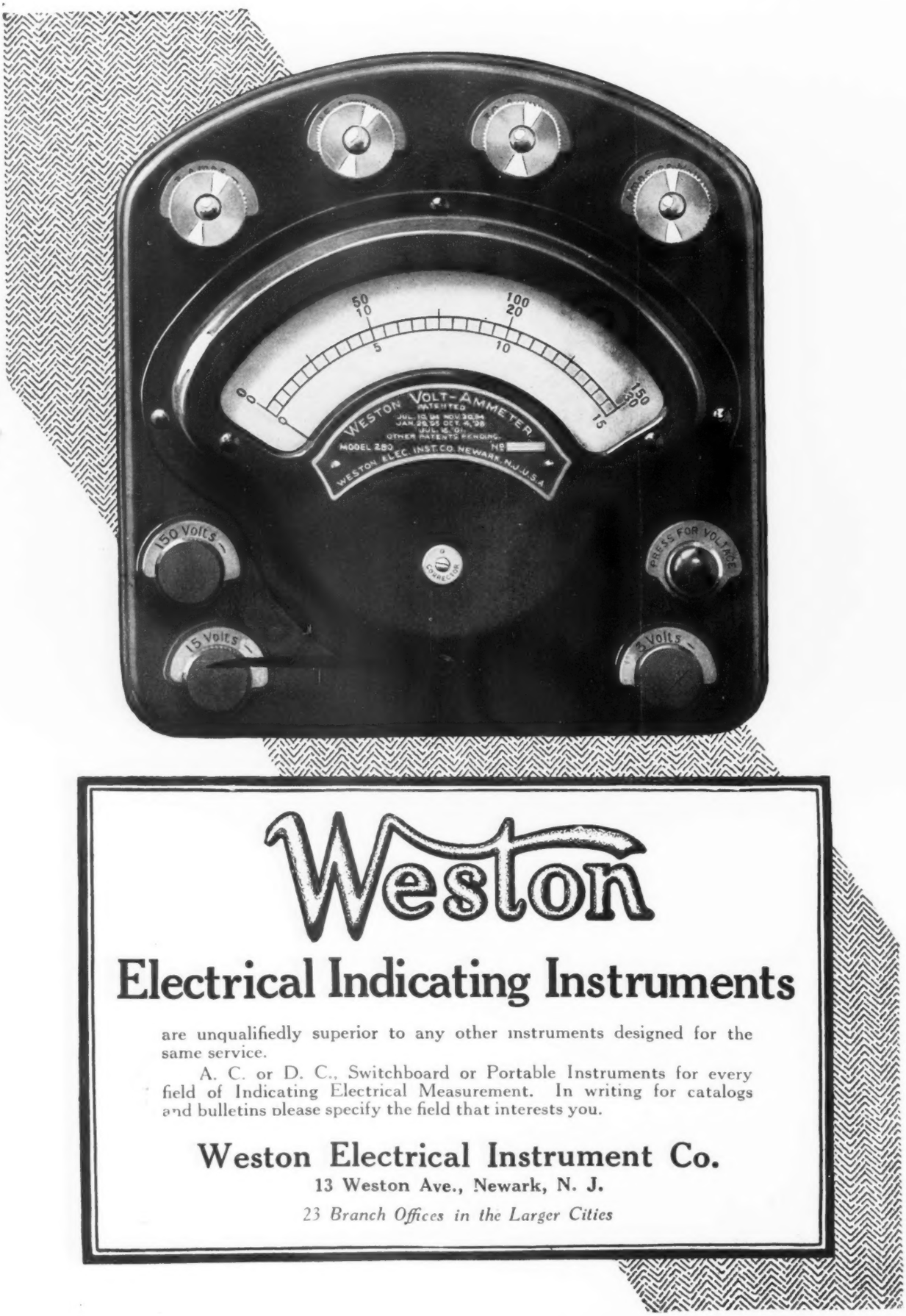

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Electrical World

F. M. FEIKER, *Editorial Director* W. H. ONKEN, JR., *Editor*

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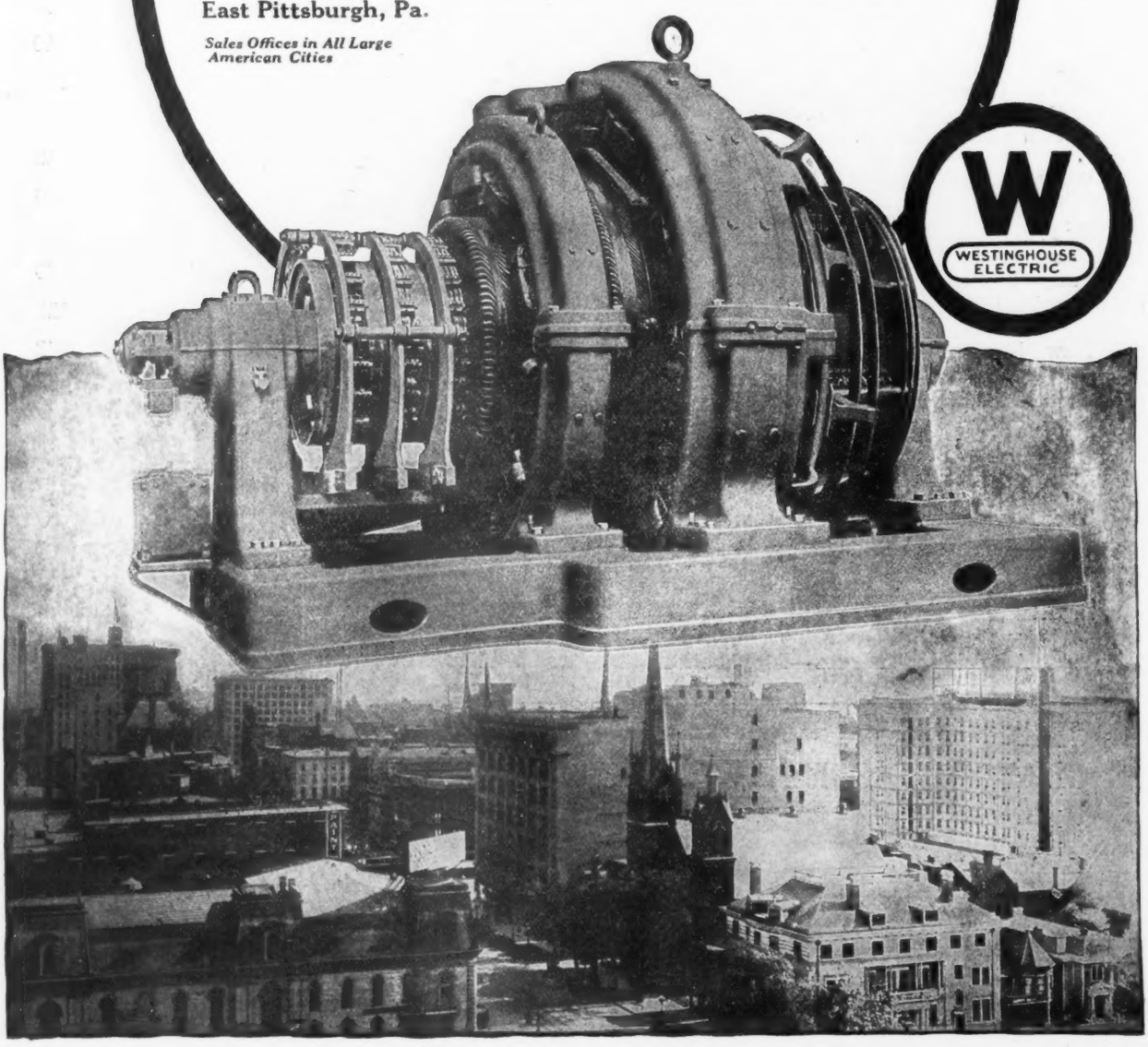


Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

Volume 72 New York, Saturday, August 17, 1918 *Number* 7

Congress Alone Needs Enlightenment

THINKING men have always recognized the necessity for the development of the water-power resources of the country for economic reasons. Nor is a proper understanding of the matter lacking in high places. The President and members of his Cabinet have openly espoused the cause and urged remedial legislation to make water-power development possible and practicable. The latest Cabinet convert is Secretary McAdoo, who looks to water power to relieve the country from the thraldom of coal and to furnish electricity for the operation of the railroads. But it is not the administrative branch of the government that needs conviction, it is the legislative branch that is still groping in outer darkness; and while it is very gratifying to have so influential a citizen as Secretary McAdoo express himself forcibly and convincingly on the necessity for hydroelectric development, it would be more so if certain senators and representatives became just as enthusiastic on the subject. The obstructionists are not in the vicinity of the White House; their abode is on Capitol Hill.

The Two Types of Research

RESEARCH is commonly understood to be the extending of the bounds of knowledge. All deliberate research bears a resemblance to the exploration and occupation of a new country. First the pioneer or explorer penetrates the wilderness and blazes a pathway; then his comrades follow and survey the land, make maps and decide what portions to select for their farms and their towns.

Likewise, in the domain of the mysteries of nature there is a necessity for the two types of men to occupy the field. First must usually come the pioneer, who, with a vision to see what is hidden from the most of us, discovers new laws and fundamental relationships of nature; then come the comparatively greater number of men who work in endowed laboratories of universities or national bureaus of standards, to amass a fund of detailed information, establish constants, melting points, etc. Both of the above are pure research and are not ordinarily the function of the commercial laboratory.

Primarily, industrial research has for its object the production of something for human need, comfort or pleasure that is better or cheaper than what was before available. Faraday was an exponent of pure research; Edison is an industrial researcher in the fullest sense.

When we consider the types of minds engaged in the scientific end of our industrial growth, we find the same division of the men into two classes—pioneers or inventors, who reach out for the unknown or new paths, and routine research men, who map out the field disclosed and determine what are the limits of operative success and point out possible improvements. It is this latter function that really occupies a large part of the time and effort of industrial research organizations. It is there that research and engineering merge.

Resisting the Heat Wave

TO US the most striking fact about the unparalleled heat of last week was not the temperature records but the small casualty lists. Had such a hot wave struck the country twenty years ago, the list of prostrations and deaths would have been very great. In past years much lower temperatures have been known to swamp the hospitals with cases of heat prostration. No doubt a large part of the credit for the gradually lessening fatalities due to heat is rightly attributable to the work of health departments and to a better understanding of the laws of hygiene by the general public. However, we are vain enough to believe that a considerable part of the credit is due to the wider use and application of electricity. Certainly, with the denser populations now prevailing in the great cities and with the temperatures recorded in those cities, the use of electricity for the operation of fans, illumination, transportation and other purposes deserves greater recognition than is ordinarily accorded to it by an unthinking public, in making the heat bearable.

Efficient Distribution of Electricity

VERY few electrical distribution systems, big or little, are actually used at anything like maximum economy. The chief reason for this condition is that in the growth the load distribution, originally well designed, falls into a state where improvement is sadly needed. Extensions are required to meet the demands of new customers or even to supply new districts. The distribution of the load, in part or in whole, is continually shifting, and the more prosperous and active the company the greater this shifting is likely to be. The time comes therefore when the sum of the changes is sufficient quite to offset the initial good design, but by changes on the whole so gradual that they are not fully

realized. When this time comes rearrangements are in order, and they may frequently be made, without prohibitive expense, to yield greatly improved economic results. W. B. Stelzner's discussion of this subject is a well-marshaled account of the exigencies of the situation commonly met and of remedies which can be applied.

The first matter for consideration, although not generally the most important, is the loss in the primary circuits, including lines and transformers. This is quite analogous to the feeder losses in a low-tension system of distribution. In the first place, the high-tension lines often cause a loss so considerable as to lower the economy of the primary distribution somewhat seriously as well as to impair its regulation. The remedy here is essentially that of readjusting the feeding system, bearing in mind that transformer losses at light load must not be forgotten, and that trouble may come not only from actual increase of kilowatts delivered but from lowered voltage and impaired power factor. In these days the latter is by no means unimportant, underloaded motors, sometimes of intrinsically bad power factor, being far from uncommon. In general the changes desirable in the primary system are rearrangement of the feeding points to provide a uniform distribution of load, corresponding changes in the size of transformers, and reinforcement of the primary lines.

The figures given by Mr. Stelzner, being based on pre-war prices, are now subject to some modification, and the balance of costs must be figured on things as they are. As the prices of the generating costs, however, have risen like those of construction, so these also must be taken into account. At the present time so much is available in the way of automatic switching apparatus that it is easily possible, if a plant is afflicted with considerable periods of light load, to cut out a portion of the transformers, leaving the remainder to feed the secondary network. Right here it should be remarked that the ordinary alternating-current station has a somewhat undeveloped secondary network, and engineers would often do well to consider this matter, bearing in mind the earlier practice of direct-current plants.

The losses in the secondary distribution are usually considerably greater than those in the primary, and they are not only the most important factor in economy but also in the equally important matter of regulation. Reinforcement of the copper frequently becomes necessary, although a great deal can be done by the addition of high-tension feeders and consequent redistribution of the secondary load. The characteristics of the secondary distribution require more careful attention than is commonly given them, especially in the numerous cases where long extensions have to be made. Particularly is this true in its effect on the energy sold. Poor regulation and low voltage mean not only increase in the general losses but decrease in the proportion of the load actually paid for, and it is no uncommon thing to find a shocking discrepancy between the load generated and that metered. Good regulators skillfully applied are well-paying investments, both in improved service rendered and in cash.

Finally, there is a good deal to be said for the four-wire, three-phase distribution, with its great capabilities for reducing losses. For some reason or other it has not been a system commonly applied, although it has been uniformly successful wherever employed, and, as recorded from time to time in our columns, the change has already been made by various plants. For a given investment in construction it probably yields more relief than any device yet tried. The long and short of the matter is that the facility of distribution with alternating currents has worked to its disadvantage. In the old low-tension direct-current days the details of the load had to be studied, for there was no convenient avenue of escape from present difficulties.

There is really no good reason why a modern alternating-current system, with its enormous flexibility, cannot be brought to the same degree of finish in the design and operation of the distributing system considered as a whole. It is not unlikely that the present high costs of labor, material and fuel may prove a blessing in disguise by forcing closer attention to details.

Electric Power on the Farm

IT WAS forty years ago last May that the electric motor found its first practical industrial occupation, and this was in the service of agriculture. The particular task accomplished was plowing, the plow being dragged back and forth across the field by a cable between a winding drum at the motor end and a movable anchorage opposite. Since that time motor applications have grown to their present millions of horsepower and have ramified in almost every conceivable department of industry. But agriculture as a field in electric working has remained in the background. The reason is rather obvious in the difficulty of getting distribution of a character to lend itself readily to anything except the mechanical auxiliary work about a farm.

The electric distribution networks stretching over a great expanse of territory often give the farmer light and perhaps a small motor for working some of the farm machinery, but nothing more except in a few places, chiefly in the Far West, where irrigating pumps form a welcome and useful part of the motor load. For what one may call the mobile operations of farming the horse has held undisputed sway until the recent arrival of the tractor; but if under stress of war the gasoline supply runs short, the tractor, the gasoline pumping engine and other farm machinery will have rather a hard time of it.

Therefore it is worth while looking toward some modern adaptations of the famous experiments of MM. Chrétien and Félix, not in the service of the sparsely sowed and scantily reaped farmlands of the Northeast, but in intensive farming which, in the scarceness of labor, takes on a new importance under the stress of war—an importance it has always deserved though seldom received. Wherever electric light is available electric motor power goes, and on ground intensively tilled the question of distribution, otherwise serious, becomes less important. Not only can a big market garden be piped for irrigation and served by an electric pump, but it would not be a difficult matter to wire several acres so that energy could be delivered after the

manner of the trackless trolley to the ordinary machinery of cultivation, including equipment for the spraying which is a necessary part of modern agriculture. Besides this use of mobile machinery, there naturally falls into line the operation of all other farm machinery by electric power, putting it into the hands of a single man to work an area of cultivation otherwise utterly out of the question, thereby not only saving a large amount of labor but freeing it for purposes that now seem more imperative. The problem furnishes a good chance for the practical inventor to distinguish himself to the very considerable benefit of the community at large. Load of this kind would be strictly daylight load with a large diversity factor and would consequently add little to the burden of energy production compared with the good accomplished. At all events, the matter is one very well worth study as a development of applied economics.

The Electric Furnace and Its Applications

A BRIEF account in this issue by W. H. Easton of a Heroult furnace for the preparation of nickel alloys gives a capital idea of the special applications of electric heating which are coming rapidly into use A furnace of this sort requires comparatively small energy at the start, but a large and fluctuating quantity when the melt is well under way. At this point the changes in furnace resistance are great and rapid, including many momentary and some persistent short circuits. High momentary overloads are characteristic of this kind of electric furnace work and require exceptionally good regulation to keep the variations of load within bounds. In this case a very ingenious Thury regulator has been installed to maintain automatically as nearly as possible a constant current at the electrodes. Each electrode is regulated separately, being provided with a motor to raise and lower it. Whenever the current from the electrode passes the limit set a momentary contact starts its motor and withdraws the electrode slightly, repeating the operation step by step until the current is down to its proper limit. With a current too low the electrode is in a corresponding fashion pushed in to the required point. Series transformers in the main high-tension circuit furnish power to the solenoid control for the regulator.

It is interesting to note that the regulating motors for the electrodes are operated on direct current, by reason of the delicacy of the control thereby obtained, a small motor-generator set furnishing the necessary power. Each electrode motor is equipped with a controller for manual operation if necessary. Finally, when the work on the charge is quite completed and the product ready for use, the whole furnace is tipped for pouring by an alternating-current slip-ring motor geared to the mechanism and controlled manually. The whole installation exhibits a very finished case of the fine automatic control of an operation requiring careful and delicate work for successful results.

Motors in the Printing Trade

PROF. C. E. CLEWELL'S notes on this subject assemble in most convenient form the data regarding motor applications in the printing plant. Much of the work here done is quite comparable to that in other branches of manufacture and demands nothing unusual in the way of motor equipment save ordinary care in the adaptation of individual drives. The presses require the closest attention to obtain successful results, and the problem in this case is quite like that encountered in the paper-making machine, where there is likewise necessity for good speed regulation, for heavy starting torque to overcome the inertia, and for inching the machinery along very gradually during certain stages of the operations. It is not unusual in large presses, indeed, to apply the same two-motor device as in the calenders, a small machine being used for the very slow movement, a big one for the regular running.

Barring starting torque, the power required by printing presses is rather suprisingly small, as Professor Clewell shows. The press-driving problem is essentially one of varying speed, and the means adopted here are substantially those used elsewhere, of varying the field and resistance in the armature circuit enough in each case to give the required range of speed. The interpole motor lends itself particularly well to such control here as in other cases. Where alternating current has to be used one is generally driven to slip-ring motors with variable resistance. As the running load of a press is fairly uniform, this arrangement can be made to work successfully despite the fact that, as in series-wound continuous-current motors, the speed varies through a certain range with changes of load. The control adopted is generally of the push-button type and frequently from several points, the form and multiplicity of control being chosen for safety and convenience.

It is in the adaptation of this type of control to the requirements of the particular printing plant considered that the greatest ingenuity can be exercised by the engineer. Aside from this, the equipment of printing machinery is a very simple matter.

The Coming Issues

FOLLOWING our policy of calling attention to interconnections that may be beneficial to all concerned, we will publish an article soon on the electrical systems in southern California, pointing out what is being considered or has been done to utilize water powers, economize in oil fuel and make use of existing equipment more fully. The selection of motors and control apparatus for elevators such as are used in apartment houses and office buildings of ordinary height will also be discussed. An article by a writer talking for the Fuel Administration will call attention to the importance of the human element in trying to obtain the maximum plant economy. Experiences of several well-known companies will be cited. Numerous arrangements for operating induction machines will be referred to, and their characteristics under different operating conditions will be obtained.

Economy in Electrical Distribution

Investigation of Losses in Distribution Systems for the Purpose of Improving the Service at Minimum Expense—Rearrangement of Equipment and Improved Construction Considered

BY W. B. STELZNER

CENTRAL-STATION companies have difficulty in getting new apparatus for their systems because all manufacturing is now primarily devoted to the purpose of winning the war. These companies must therefore use every device to maintain their service by getting the maximum use from existing apparatus and must use the greatest care in purchasing new equipment. To this end greater effort must be made to study the losses in distribution and to reduce them by the best means. When automatic voltage regulators are used on lighting feeders, for instance, it may be possible to open the primary circuits during the light load period and thus save 75 per cent of the iron loss.

It is generally known that if the primary lines of a distribution system are too small an excessive copper loss results, but it is not so well understood that if the voltage at the load is low the power is correspondingly decreased and a definite loss of revenue occurs. Larger conductors are thus required. In the case of low-tension circuits, however, line losses may often be reduced and the service improved by changing the transformer locations. Another serious obstacle to economical distribution is low power factor at the load, which causes high line losses and seriously limits the capacity of the wires. This condition may usually be attributed to the operation of induction motors on the system at only partial load, and is obviously best corrected by rearrangement of the motors or if this is not feasible by the use of synchronous motors.

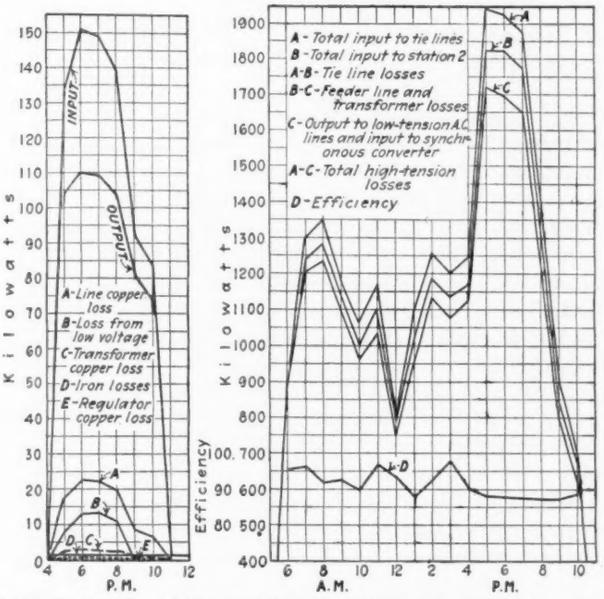
An analysis of the losses on the lines of a company of medium size was recently made and some of the results will be reviewed in order to show the economic importance of these losses in the distribution of electricity. The losses that will be discussed are: the high-tension-line copper loss, the low-tension-line copper loss, the induction regulator losses and the transformer losses. The copper losses will apply to the conditions obtaining for the average winter load.

The system studied includes a generating station connected by four lines to a substation from which emanate three lighting feeders and one power feeder. These feeders are equipped with single-phase regulators and supply current at approximately 2400 volts. A synchronous converter also supplies a railway load from the substation.

HIGH-TENSION-LINE COPPER LOSS

The high-tension-line copper loss is given in Fig. 1, which shows the condition existing in one of the lighting feeders. The curves show this loss to be 98 kw.-hr. for a twenty-four-hour period, or 16.6 per cent of the energy sold in the same time. This large line loss is accompanied by an excessive pressure drop with the result that the pressure at the load is below normal and a direct loss in the sale of energy ensues. When the load current is 51 amp., the regulator reaches the position of maximum boost and any increase in load current produces a fall of voltage, entailing a loss of revenue.

In this case the obvious remedy is to increase the size of wire in order to reduce the line drop sufficiently to permit the induction regulator to hold the voltage up to normal. The loss of energy may be calculated at the rate of 7 cents per kilowatt-hour, assuming that the added cost of supplying this energy would be small. As will be noticed, the line copper loss is appreciable only between 5 and 10 o'clock in the evening. Although this loss occurs at the peak load, a possible minimum value for the loss, the cost of coal, might be 0.5 cent per kilowatt-hour. Using pre-war prices for material and labor and an annual charge of 10 per cent for interest, depreciation, insurance and taxes, the saving by replacing the No. 6 wire used with No. 2 is as follows:



FIGS. 1 AND 2 — LOSS CURVES FOR SINGLE-PHASE FEEDER AND EFFICIENCY OF HIGH-TENSION SYSTEM

Maximum copper loss occurs at peak load and may thus limit rating of line. Iron losses are ever present, however.

No. 6 B. & S. Wire		No. 2 B. & S. Wire	
Cost of wire as installed to point *a*, Fig. 5	$239.00	Cost of wire	$602.00
		Changing wires	80.00
			$682.00
		Credit for removed wire	75.00
		Cost of change	$607.00
24-hr. capital charge	.06		.17
24-hr. cost of line loss	.49		19
24-hr. loss due to low voltage	3.36		.00
Total 24-hr. charge	$3.91		$0.36

The calculations indicating the economy resulting from the selection of a No. 2 wire for this circuit are summarized in the following tabulation:

Wire Size, B. & S. Gage	4	2	1/0	2/0	3/0	4/0
Additional capital required for change to above wire size	$385	$607	$985	$1,235	$1,545	$1,955
Total twenty-four-hour charge	$0.40	$0.36	$0.40	$0.43	$0.49	$0.60

The No. 2 wire carries the smallest charge and the capital expenditure required in its installation will be recovered within one year's time owing to the decrease in operating costs. The economy resulting from the substitution of the larger wire is very evident.

LOW-TENSION-LINE COPPER LOSS

The low-tension-line drop is probably the most important element in maintaining a high standard of service.

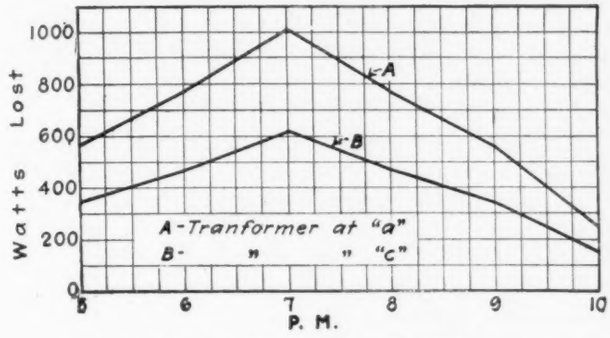


FIG. 3—LOW-TENSION-LINE LOSS

Curve A for the circuit shown in Fig. 5 with transformer at *a;* curve B with transformer at *c.*

This becomes apparent when we consider that by means of voltage and power-factor regulators the pressure of the high-tension lines can be controlled. With a well-designed system and under efficient operation these regulators give practically constant voltage at the distributing centers. Especially is this true when lighting feeders are maintained separate from the power feeders. Such apparatus is not used on the low-tension lines and the regulation at the loads is therefore determined almost altogether by the low-tension-line drop.

The line losses in the low-tension circuit are indicated in Fig. 3. These data give the copper loss in the line wires and service leads and show the influence on the losses of the design of the circuit. The information may also be presented as follows:

	Curve A	Curve B
Transformer size (kva)	20	20
Energy sold (kw.-hr.)	90.7	90.7
Line loss (kw.-hr.)	3.94	2.39
Per cent lost	4.2	2.6

A comparison of curves A and B indicates which is the most economical location for the transformer feed-in point. This is a most important consideration both with regard to the losses and to the regulation at the loads. The cost of moving this transformer to the position indicated would be $5.50, a sum fully warranted in view of the improvement in losses and regulation. A further change that might be warranted would be to change the size of wires *ab* and *bc.* In some cases other considerations may govern the selection of the transformer location, and position *a,* Fig. 5, may be chosen. In this event the change in wire sizes must be made or the circuit may be sectionalized and another transformer installed.

POWER FACTOR

The power factor of a circuit depends not only upon its characteristics but those of the apparatus connected to it. To transmit 100 kw. at 2400 volts single-phase would require a line current of 41.6 amp. if the power factor is unity, and a current of 52 amp. if the power factor is 0.80. Due to this increased current at reduced power factor, the copper loss in apparatus and lines is increased in proportion to the square of the decrease in the power factor. Low power factors, therefore, mean greater losses, lower capacity and decreased economy in distribution. The power factor of a circuit may be changed by a rearrangement of motors and loads, so that all induction motors will be operating under approximately normal load conditions, or synchronous machines may be used of sufficient rating to control the power factor of the circuit.

For the circuits involved in this study the power factor of the lighting feeders averaged 0.92 at peak load and 0.42 at no load. The power feeder, owing to lightly loaded induction motors and transformers, had an average power factor of 0.52. The power factor of the tie lines was usually kept above 0.90 by over-excitation of the synchronous machine supplying the railway load.

Fig. 4 gives the loss in the tie lines for two loads, a day load and a night load, and shows how this loss would vary with the power factor. Suppose an induction motor-generator set were used in the substation and that this should result in a tie-line power factor of 0.85 for the night load and 0.70 for the day load. Then results would be as follows:

Time	Actual Loss (Kw.)	Assumed Power Factor	Resulting Loss (Kw.)	Loss Due to Reduced Power Factor (Kw.)
7 p.m.	108	0.85	141	33
10 a.m.	66	0.70	117	51

The reduction in line loss by power-factor correction, with its accompanying effects on the pressure regulation at the substation and on the capacity of the tie lines, measures the economic value of power-factor control and its influence in the selection of power equipment.

VOLTAGE REGULATION

Pressure regulation is involved in all distribution problems and it is an important factor in electric service. Good regulation means minimum losses and maximum sale of energy.

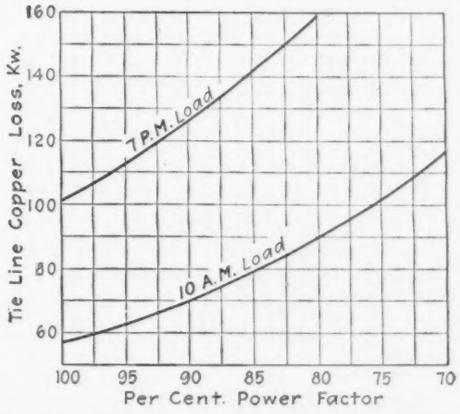


FIG. 4—VARIATION OF TIE-LINE LOSS WITH POWER FACTOR

By separating the lighting and the power loads and supplying them by different feeders, as is done in the system studied, individual control of each is possible and the best regulation may be secured. To accomplish this automatic voltage regulators are required for each circuit.

The fluctuating power loads produce power factor

and current variations in the tie lines, and these two effects combined with variations in the generated voltage determine the fluctuations of the pressure at the substation bus. This pressure may be controlled by the use of an automatic voltage regulator in connection with the synchronous machine in the substation, as in this way the power factor may be held constant. A similar regulator, if required, installed at the power station would control the pressure generated there.

INDUCTION REGULATOR LOSSES

The loss in energy sold due to low voltage at the load, as shown by Fig. 1, is caused by resistance of the line. The loss is kept as low as that given by means of the boosting action of the induction regulator, increasing the phase pressure from 2400 to 2600 volts. The influence of the regulator in controlling this loss is determined as follows:

Energy delivered to the circuit as installed (kw.-hr.)	757.8
Energy that would be delivered without regulator (kw.-hr.)	626
Difference during the period of twenty-four hours (kw.-hr.)	131.8

This indicates the decided usefulness of the regulator even without considering its chief function of improving regulation.

The regulator which was under consideration was rated at 11.5 kw., 2200 volts, 50-amp. secondary. It was

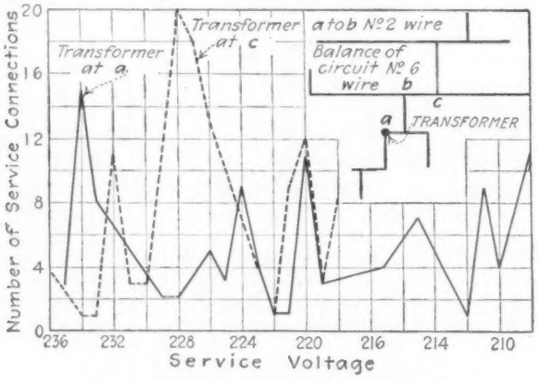


FIG. 5—VOLTAGE AT SERVICE CONNECTIONS

Full line shows number of services receiving a given voltage at peak load. Dotted line shows the improvement resulting from moving transformer from *a* to *c*.

an old design with a tested iron loss of 400 watts and a copper loss at rated load of 187 watts. The high iron loss is partly due to the fact that it is subjected to a pressure 9.1 per cent in excess of that for which it was designed. The exciting current was found to be 2 amp. For a regulator of modern design the iron loss would be about 160 watts and the exciting current 1.89 amp.

A comparison of the losses for a year's time gives the following results:

	Old Regulator	New Regulator
Annual cost of iron loss	$17.51	$6.57
Annual cost of copper loss	2.61	4.53
Total annual loss	$20.12	$11.10

or an annual saving in losses of $9.02 in favor of the modern design. This saving alone, however, would not justify the increased capital expenditure required to make the change.

The greatest economy in this case would be realized by installing switches in the shunt coils of the regulators so they may be disconnected during the nineteen hours per day of light or no load. This would result in an annual saving in iron loss of $13.75 per phase or $41.25 per feeder. Assuming a three-pole switch, installed, to cost $75 and an annual charge of 13 per cent, we have an annual charge of $9.75 on the switch. The net saving, if the switch is used, amounts to $31.50 per feeder per year. The iron loss of all transformers on one circuit amounts to 1.2 kw. At a cost of 0.5 cent per kilowatt-hour the annual cost of this loss is $52.60. With rated voltage at each transformer and with transformers of modern design the annual cost of the iron loss would be $47.80, a saving of $4.80 per year. Obviously this saving alone would not justify the replacement of these transformers with others of the proper voltage rating.

SUMMARY OF LOSSES

In order to show the relative magnitude of the losses as studied, the following table applying to one circuit is given for the twenty-four-hour period considered.

Transformer iron loss (kw.-hr.)	28.8	
Regulator iron loss (kw.-hr.)	9.6	
Total iron loss (kw.-hr.)	38.4	
Per cent of total loss		20
Transformer copper loss (kw.-hr.)	12.5	
Regulator copper loss (kw.-hr.)	1.4	
Line copper loss (kw.-hr.)	98.0	
Total (kw.-hr.)	111.9	
Per cent of total losses		56
Loss due to low voltage (kw.-hr.)	48.0	
Per cent of total loss		24
Total loss (kw.-hr.)	198.3	
Total input (kw.-hr.)	788.4	
Total output to low-tension lines (kw.-hr.)	590.0	
All-day efficiency, per cent		75

The total losses in the high-tension system are as follows:

	Kw.-hr.
Energy to tie lines	21,440
Energy to bus at substation	20,360
Loss in tie lines	1,080
Loss in feeders, regulators and transformers	1,114
Total loss	2,194

CONCLUSIONS

Knowledge of the actual losses and their distribution over the system is essential to the most economical operation. Such data show just where more copper is needed, where copper may be removed, where to install regulators and power-factor-correcting devices, the most economical location of transformers, etc. In other words, a knowledge of the distribution losses is necessary for the most effective use of the system or the production of maximum service at a minimum cost.

The line copper loss, since it varies with the square of the load current, is likely to be serious. The gradual growth in load may result in large line losses or changes in the distribution of the load may result in idle copper. A survey of the losses reveals these conditions and leads to their correction.

The iron losses are kept low on this system by reason of the fact that the transformers are so spaced as to supply rather large areas. In this way larger as well as fewer transformers are used with a resulting reduction of iron losses and exciting current. This practice also results in a lower investment in transformers. Another advantage lies in the fact that by supplying the larger area a reduction in transformer rating is possible because of the diversity factor of the connected load. In some cases, however, these economies may be more than offset by the losses in the low-tension lines. Economies can be obtained by using larger trans-

formers and increasing the distance between them when such a policy is consistent with the investment in the low-tension mains.

Power-factor correction on lines carrying loads of low inherent power factor results in a material saving in line loss and line capacity and a decided improvement in regulation.

The value of a study of the losses encountered in the distribution of electricity is made apparent by considering the fact that the ultimate cost of the product depends on the efficiency of the system. High efficiency, though a desirable attribute, cannot always be fully realized if the system is to have its greatest value. Low capital cost is essential to low production cost and low capital costs are influenced by losses as well as by diversity, load factor, available funds, etc. On the other hand, a mistaken economy in capital costs may act to seriously impede the development of the system. While no system can be laid down as commercially complete, the engineer must look, although it may be far into the future, to what would probably be the demand if the whole energy consumption of the district were supplied electrically.

The rapid growth in the load so often experienced illustrates the necessity for a rather generous attitude on the part of the public toward the utility in order that this increase may be properly taken care of and the best interest of both public and company conserved.

Electric Furnace for Melting Alloys

Control Apparatus Must Be Carefully Selected to Provide for Heavy Fluctuation of Load—Graphic Records of Power Demand When Melting Nichrome and Nickel Steel in Electric Furnace

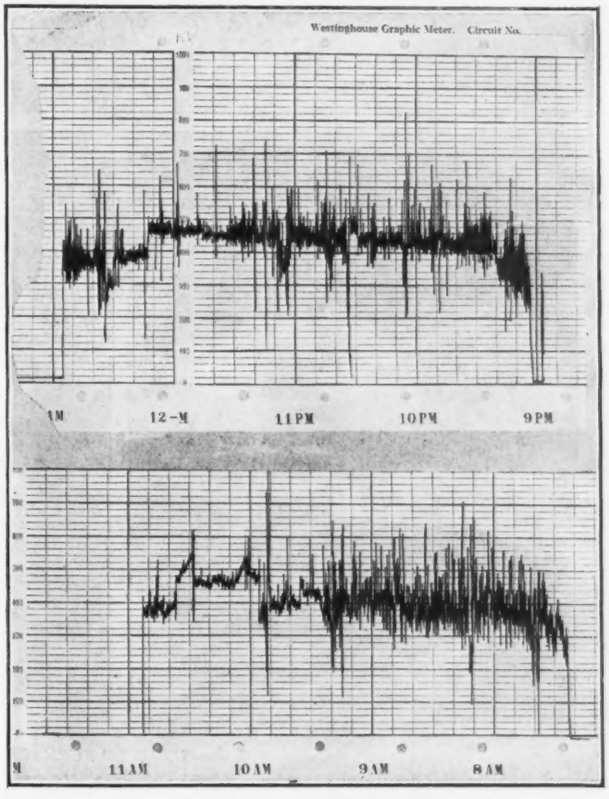
BY WILLIAM H. EASTON

AN ELECTRIC furnace which has recently been put in operation at the plant of the Driver-Harris Company, Harrison, N. J., is of interest because it is used for the preparation of special alloys and because its electrical equipment is an excellent example of modern practice. Its main product is nichrome, the well-known resistance alloy, but it is also used for making alloys of a different character. The furnace is of the Heroult arc type with automatic regulation, and has a capacity of 2 tons.

Fig. 1 is a graphic wattmeter record of the power consumed during a run on 3000 lb. (1361 kg.) of nichrome, and Fig. 2 is a similar record for high-nickel steel. In both cases the charge consisted of the various metallic constituents fed into the furnace in a solid state without preheating. The amount of power taken at the start of the heat is small in both cases, but as the resistance of the furnace circuit decreases, owing to the heating up of the electrodes and the consolidation of the charge, the power consumption rapidly increases until stable conditions are reached. The average amount of power consumed is then held practically constant by the automatic regulator, with the exception of a slight continuous increase due probably to a corresponding decrease in the resistance of the furnace circuit.

There is, however, no uniformity in the actual power consumption. As the charge melts down, pieces of metal fall in between the electrodes and establish short-circuits. For the most part these short-circuits are only momentary as the fragments causing them are promptly melted down; but occasionally they persist and then the automatic regulator draws up the electrodes until they are clear. This process sometimes breaks the arc and then there is a sudden decrease in the power consumption until the regulator brings the electrodes down again and re-establishes the arc. As would be expected, the nickel-steel alloy shows more of these irregularities than the softer nichrome.

Toward the end of the run there is a marked change in the power consumption, when the metal is given a special treatment before pouring. In the case of the nickel-steel a higher temperature was necessary, perhaps to lower the carbon content, while with nichrome the temperature was lowered. The temperature of the furnace averages about 2200 deg. Fahr. (1204 deg. C.).



FIGS. 1 AND 2—GRAPHIC WATTMETER RECORD FOR NICHROME AND NICKEL-STEEL MELTS

The power required for melting nichrome changes rapidly from practically open-circuit to short-circuit. Fluctuation of power is even more marked with nickel-steel than with nichrome on account of the character of the charge.

The high momentary overloads are characteristic of

electric furnace work and make it very different from ordinary power service. They must be taken into account in designing the electrical equipment for the furnace, and some of the apparatus must be especially designed to withstand them, as shown in the following description of the Driver-Harris installation.

Energy for this furnace is supplied from a two-phase, 60-cycle, 2200-volt circuit on the lines of the Public Service Electric Company. In the high-tension lines are a disconnecting switch and an oil circuit breaker. This breaker, used to control the circuit, may be operated manually and is also provided with low-voltage and overload protection. In order to prevent its operation on momentary overloads, the overload trip is controlled by relays with definite inverse-time-limit action. The high-tension apparatus and the transformers are contained in a brick compartment constructed behind the furnace.

There are two 400-kva., 2200/110-volt transformers of the oil-insulated self-cooled type. They are T-connected so that they change the high-voltage two-phase current into low-voltage three-phase current, one phase for each of the three electrodes of the furnace. Special construction is necessary to withstand the overloads. These overloads are of such short duration that their heating effect is negligible, but they tend to force the coils apart. Hence the coils are very firmly braced and are capable of withstanding momentary overloads fifteen times greater than the normal load. The reactance of these transformers is about double that of ordinary power transformers of the same size. This reactance, together with that developed in the low-tension leads (which are made as short as possible in order to keep

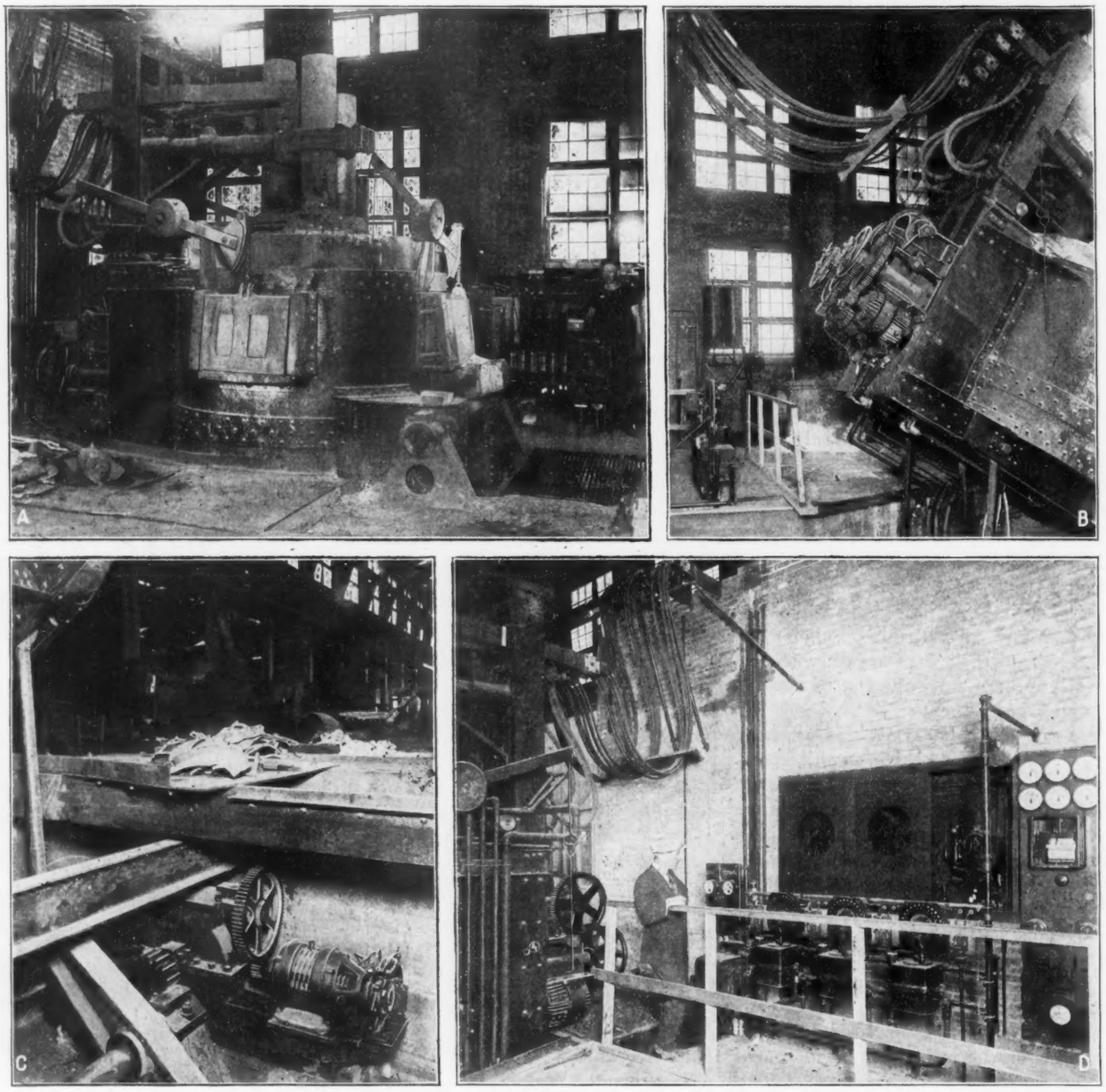


FIG. 3—VIEWS OF FURNACE AND CONTROL APPARATUS

A—Furnace during normal operation—heavy carbon electrodes shown above. B—Tilting position for discharging the melt—large flexible electrode leads above. C—11-hp. motor for tilting furnace—motor is alternating-current slip-ring type. D—Thury regulator at rear of furnace; on the right the control and meter panels are shown.

this factor low) prevents the current flowing through the furnace from exceeding five or six times normal values even on dead short-circuits. The voltage regulation is from 106 volts on no load to about 100 volts on full load, and the power factor is from 85 to 90 per cent.

One of the most interesting features of the equipment is the Thury regulator, which automatically maintains an approximately constant current at the furnace electrodes. Without this device the current consumption would vary erratically even if an operator were constantly endeavoring to correct the variations. It therefore saves labor and energy, reduces to a minimum the time required to prepare a charge, and, by providing uniform conditions, keeps the quality of the product uniform.

OTHER FEATURES OF EQUIPMENT

Each furnace electrode has a separate regulating mechanism and a raising and lowering motor. The regulator can be set for any desired current value, and when this value is exceeded each regulating mechanism closes a contact momentarily, which causes the motors to raise the electrodes slightly. The contacts continue to close at brief intervals until the electrodes are drawn up high enough to reduce the current to the predetermined value, the intermittent action being employed to prevent the electrodes from being raised too high and thus causing an unstable condition. When the current falls below the predetermined value the electrodes are lowered in a similar manner. The regulator itself is controlled by a solenoid energized by means of current from series transformers in the main high-tension circuit. Damping devices prevent the regulator from acting on overloads that immediately correct themselves. In addition to the automatic device, each electrode motor has a drum controller for manual operation.

The electrode motors are direct-current machines, because alternating-current motors cannot be controlled with sufficient delicacy. The operating current is obtained from a 4½-kw. motor-generator set located in the transformer compartment. The motors are of 2 hp. capacity and are totally inclosed; they are provided with grease-cup lubrication instead of the ordinary ring-oiling system, so that the lubrication is not interfered with when the furnace is tilted for pouring.

An instrument board is located beside the regulators and carries the following apparatus: An indicating wattmeter; a voltmeter; a power-factor meter; an ammeter for each phase; a graphic wattmeter; a plug switch for reading the voltage of each phase, both across the arc and across the low-tension leads outside the furnace; the operating handle of the high-tension circuit breaker; the inverse-time-element relays for the circuit breaker, and an integrating watt-hour meter. On the other side of the regulator is mounted a small panel carrying the switches and meters for the motor-generator set, below which is the motor auto-starter.

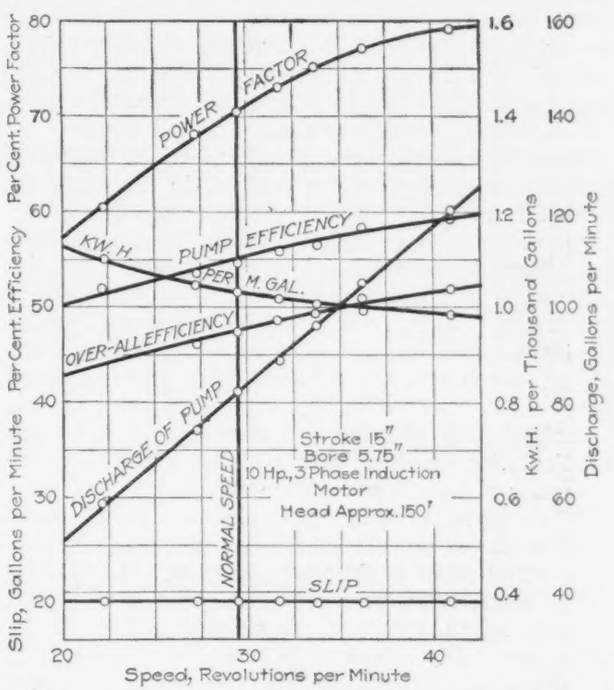
When the charge is finished, the whole furnace is tilted bodily for pouring. This tilting is effected by an 11-hp. alternating-current slip-ring motor located in a pit beneath the furnace and geared to the tilting mechanism. It is controlled by a drum controller at the side of the furnace. All of the equipment described is standard Westinghouse furnace apparatus.

THE WAR-TIME OPERATION OF MOTOR-DRIVEN DEEP-WELL PUMPS

Discussion of the Characteristics of Reciprocating Pumps Applicable to Other Systems of Pumping or to Pumping Oil

BY P. S. BIEGLER AND I. W. FISK
Department of Electrical Engineering, University of Illinois

IN MAKING an investigation of the performance of electrically operated reciprocating deep-well pumps serving communities of small or average size it is not uncommon to find the over-all efficiencies of the individual pumping units anywhere between 30 and 60 per cent. It is not hard to find reasons for this uncertainty of efficiency in water-pumping systems. They usually serve small towns and cities, and the business may not warrant paying high salaries to superintendents. Commonly these pumps are equipped with motors



CHARACTERISTICS OF PUMPING UNIT FOR VARYING SPEEDS OF PUMP

that are larger than necessary, which may be justified for the reason that the level of the ground water may vary from year to year and that the valves may not be operating properly, or there may be mechanical defects which prevent good performance.

It is evident then that close and intelligent supervision and periodic testing of pumping systems should prove profitable, but it is still more important that every utility should meet war conditions by increased efficiency and economy. Pump tests cannot be made without apparatus especially adapted to the work. A system of testing developed by the writers*, together with some plotted results, is given here to show how this work can be accomplished.

Of the faults frequently found in pumping apparatus the use of a much larger motor than necessary is per-

*For details of apparatus used see paper by I. W. Fisk and P. S. Biegler, "Some Tests of Electrically Operated Deep-Well Pumps," *Journal American Water Works Association*, November, 1917, Vol. 32, page 8.

haps the most common and the most serious in its consequences, because the motor may operate at extremely poor power factor and also at low efficiency. On account of the low power factor, the generating apparatus must be much larger than should be required if the power factor were reasonable, and the excess of lagging current imposed upon the distribution lines may cause poor voltage regulation. The power factor of the generating plant may, of course, be raised by the use of a synchronous motor, but this is costly and only a partial cure, since the motors continue to operate at low power factor and efficiency. The best remedy for such conditions is to rearrange the motors, where possible, so that each one is properly loaded and to dispose of the rest to the best advantage, buying new motors where necessary.

Testing Motor for Proper Load

In making tests to determine whether a motor is properly loaded, it is not sufficient to find out whether it is running at a reasonable temperature, since, at low power factor, the motor may run warm at only a fraction of full load. Furthermore, if the valves need attention, this fact may be readily determined by a decrease in the pumping rate which is indicated by the reduced load on the driving motor. While it may be possible to detect a sudden decrease in the water delivered from a well merely by observation of the discharge stream, it is evident that systematic measurement would be more certain and more useful. The most convenient method is to measure the electrical input to the motor. Then, from characteristic curves plotted against kilowatt input, the current, power factor, horsepower output, etc., may be determined. The measurement of the power or current input of a motor driving a reciprocating pump is best accomplished by means of a rotating standard watt-hour meter provided with a number of current and voltage ranges.

Where there is considerable uniformity in the equipment of the wells, it is not difficult to get at the complete performance of the motor, knowing the power input by reference to the characteristic curves. However, periodic tests should be made on each motor. If the motors are fairly well cared for, there is no reason why the characteristics should change appreciably from year to year, and the performance curves should be useful for this purpose as long as the motor runs satisfactorily.

While the measurement of power input at each motor is an excellent means of checking periodically the discharge of each well, it is desirable to make more complete tests from time to time, including the measurement of head and actual discharge. This may be done with nearly the same degree of accuracy as in the case of the electrical power measurement by the use of appropriate devices.

The curves reproduced herewith show the characteristics of a motor-operated deep-well reciprocating pump illustrating the effect upon operation of varying the speed of the pump. The actual slip of the pump does not increase with the speed, and it is rather a function of the head against which the pump is working. The pump efficiency rises on this account with higher speeds, and the over-all efficiency increases in about the same proportion when the motor is operating on the flat part of its efficiency curve.

The fact that the output of a well may be increased considerably by speeding up the pump, and that it will thereby operate at higher efficiency, should not be overlooked because every possible method of increasing efficiencies must be utilized in war time. Also, in some communities a considerably greater output of water has been required to supply an increasing population due to growing war industries. It may not be possible for pump manufacturers to supply this sudden demand, so that instead of drilling and equipping new wells it may be desirable to speed up pumps now in use, which should be utilized to their full rating even at the expense of some increased maintenance. The operator must proceed with discretion, of course, for the pumps should not be speeded up indefinitely. It has been pointed out that the possibility of increased output without added well equipment is sound engineering policy in normal times, but the suggestion assumes double importance as a possible war measure.

While the foregoing discussion is based primarily on water systems, the principles might be applied to the pumping of oil. It is quite certain that an increased demand for fuel oil will be developed by our war activities.

TEAM SYSTEM IS THOUGHT TO BE BEST LABOR SOLUTION

Heavy Industrial Demand for Labor at Youngstown, Ohio, Makes Conditions Severe—Many Trying Situations Confront Employers

Labor conditions affecting public utilities are as difficult at Youngstown, Ohio, as at any point in the country, according to H. W. Bromley, engineer of power production for the Mahoning & Shenango Railway & Light Company. As a result of this the company has come to the policy of paying wages as high as any of the neighboring industries, including the steel mills. Common labor, which two years ago was paid 17.5 cents an hour, is now getting 54 cents an hour. Watch engineers are being paid $173.50 per month for nine-hour-a-day shifts; switchboard men receive 52 cents an hour and work nine hours; oilers and water tenders are paid 45 cents and 51 cents an hour respectively, and foremen are paid from 45 cents to 48 cents an hour. Besides being expensive, this labor is difficult to handle, and constant friction arises.

Bonus systems have been tried, but without success. The latest plan, and the one which seems to Mr. Bromley to be destined to give the best results, is one which he calls the team system. With this plan a foreman paid 70 cents an hour is placed in charge of five or six men. This unit is called a team. The foremen are held responsible for the quantity and quality of work done by the team as well as for destruction of material by its members. The teams are usually chosen so that all of the men in each unit, including the foreman, are of the same nationality. The real bosses of the job then talk to the foremen, but never to the men. This plan gives the foreman a good opportunity to keep in close touch with all members of his team and to bring out their best efforts. Of all the groups employed under this system negroes are said to have accomplished the best results.

New England Interconnection Plan in Shape—II

Most Economical Plants Will Run Almost Continuously and Inefficient Plants During Peak Loads—Details of the Changes Which Have Been Found Necessary to Tie Plants Together

REFERENCE was made in the last issue of the ELECTRICAL WORLD to the study which is being made of the financial and engineering problems involved in the interconnection of New England plants. The present method of operation and the proposed plan of making the interconnections were outlined.

The theory upon which this program of interconnection has been developed does not involve the permanent discontinuance of any of the generating plants composing the complete system. On the contrary, each plant will be required to operate its generating equipment some portion of each year, the most economical plants running almost continuously and the inefficient stations for a portion of each day for periods of thirty to forty-five days each year during maximum load times, according to location. In this way the full capacity of the entire group can be rendered available as required. The sphere of action of each of the main sources of supply which would be utilized for the larger part of the year, excluding the maximum load period each winter, is indicated in Fig. 4.

The simplicity of the entire system will be appreciated by a study of Fig. 2, by which it will be noted that economical plants of large capacity are installed at each end, with another in the middle of the system, thus affording efficient means of supplying the various blocks of load locally around each generating station and avoiding transmission losses of any moment. It is obvious that the successful and economical operation of such a system will involve the control of the use of each plant under the direction of a competent central authority who will be qualified to determine the methods of operation by which the best results can be secured for all.

A study of the losses in transmission which would be experienced in the completed system, if arranged and operated in agreement with the general scheme suggested in Fig. 4, indicates that with the estimated output of 1918 they would not exceed those developed by the railway company in the same year.

The following step-by-step procedure has been worked out as desirable, taking into account deliveries of equipment and the time required for construction:

1. Install cable connections and transformers to connect the substations of the Fall River Electric Light Company and the Bay State Street Railway in Fall River.

2. Replace 25-cycle rotary converters in railway substation at Fall River with 60-cycle units and operate from Fall River Electric Light Company's system.

3. Install connection to New Bedford plant.

4. Replace 25-cycle rotary converters in railway substation at Taunton with 60-cycle units and operate from Fall River Electric Light Company and New Bedford company jointly.

5. Make similar change at Bridgewater railway substation to No. 4.

6. Install connection to Brockton Edison generating station at East Bridgewater.

7. Replace 25-cycle rotary converters in railway substation at Brockton and operate from Brockton Edison company.

8. Replace 25-cycle rotary converters in railway substation at Rockland and operate from Brockton Edison company.

9-10. Install frequency changers in Bay State generating plant at Quincy Point and install cable connections to Boston Edison company.

11. Connect plants of Quincy Electric Light Company, Weymouth Electric Light Company, Braintree and Taunton municipal plants as convenient.

12. Connect lines to Portsmouth and Newport, R. I., as installed.

Manufacturers of rotary converters, transformers and frequency changers guarantee delivery in four to five months; conduit and cable work and construction in the various stations can be completed within five

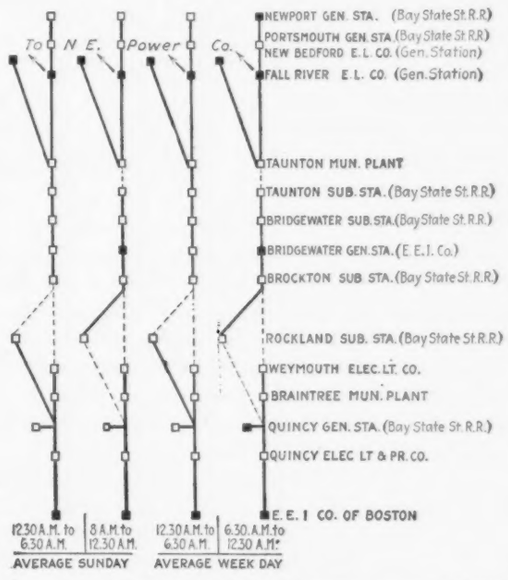

To N. E. Power Co.
NEWPORT GEN. STA. (Bay State St.R.R.)
PORTSMOUTH GEN. STA. (Bay State St.R.R.)
NEW BEDFORD E. L. CO. (Gen. Station)
FALL RIVER E. L. CO. (Gen. Station)
TAUNTON MUN. PLANT
TAUNTON SUB. STA. (Bay State St.R.R.)
BRIDGEWATER SUB. STA. (Bay State St.R.R.)
BRIDGEWATER GEN. STA. (E. E. I. Co.)
BROCKTON SUB. STA. (Bay State St.R.R.)
ROCKLAND SUB. STA. (Bay State St.R.R.)
WEYMOUTH ELEC. LT. CO.
BRAINTREE MUN. PLANT
QUINCY GEN. STA. (Bay State St.R.R.)
QUINCY ELEC. LT. & PR. CO.
E. E. I. CO. OF BOSTON
12.30 A.M. to 6.30 A.M.
8 A.M. to 12.30 A.M.
12.30 A.M. to 6.30 A.M.
6.30 A.M. to 12.30 A.M.
AVERAGE SUNDAY
AVERAGE WEEK DAY

FIG. 4 — SCHEMATIC DIAGRAM SHOWING MOST ECONOMICAL METHODS OF OPERATION

Filled-in squares indicate that a generating station is operating, while empty squares indicate that it is being held as a reserve. Stations joined by heavy lines are served by the generating station operating in that group. The dashed lines indicate connections that can be made if necessary.

months; all overhead-line construction with the exception of the New Bedford connection can be completed within three months, and it is estimated that if the right-of-way for the latter can be secured without delay, it should be completed within six months. In general, with careful attention to scheduling the work, it appears that the entire program of interconnection could be completed within six months from the date when authority was given to start construction.

It has been pointed out that the generating capacity of the system can be materially increased in the future, at a minimum cost, by installing additional boiler capac-

ity only, in certain stations where the generator capacity now predominates.

	Boiler Capacity, Kw.	Generator Capacity Kw.
Bay State Street Railway, Quincy, Mass.	15,000	22,500
Brockton Edison Company	14,000	19,000
New Bedford Gas & Edison Light Company	28,000	37,000

The capacity of the Brockton Edison company's station can be increased by the installation of an additional 10,000-kw. turbo-generator in accordance with the original design of the station as now constructed.

No data have been included in this investigation on the capacity and output which can be derived from the connection with the New England Power system at Fall River. This connection will form a valuable adjunct to the interconnected system in many ways and eventually be a source of the sale of energy to the New England Power Company, which requires additional output to supplement its present capacity.

TABLE I—REPRESENTATIVE COST DATA IN ESTIMATE

Switching and two two-way metering equipments for two 4/0, 15,000-volt lines at one generating station	$16,000.00
Four-duct conduit, per foot, laid	3.00
4–0 three-conductor, 15,000-volt cables, installed, per foot	2.30
Two 2000-kw., 13,200/2300-volt transformers, installed, with switching and two two-way metering equipments, per kw	5.00
Two 3750-kw., 25-60-cycle frequency changers, with switching and metering equipment, per kw	15.00
Two 400-kw., 13,200/2300-volt transformers, installed with switching and two-way metering equipments, per kw	10.00
Two 1500-kw., 13,200/6600-volt transformers, installed with switching and two two-way metering equipments, per kw	5.50
Replacing three 300-kw., 25-cycle rotary converters with three 300-kw., 60-cycle rotaries, per kw	8.50
Two one-way metering equipments for above	1,000.00
Replacing one 1500-kw. and three 750-kw., 25-cycle rotaries with 60-cycle machines of the same capacity, per kw	7.00
Four one-way metering equipments for above	2,000.00
Replacing three 500-kw. 25-cycle rotaries with 60-cycle units, per kw.	8.00
Replacing four 750-kw., 25-cycle rotaries with 60-cycle units, per kw.	7.50
Two 3750-kw., 23,000/13,200-volt transformers, installed with switching and two two-way metering equipments, per kw	5.00
One mile six-duct conduit	16,300.00
Four miles three-conductor, 4/0 15,000-volt cable at $2.30 per foot, total	48,576.00
Eighteen miles 66,000-volt overhead line, three 1/0 wires, per mile line	6,000.00
Cable, 25,000-volts, laid, per foot	2.00
Cable, 25,000-volts, laid, submarine crossing, per foot	5.00
Three 500-kw., 60-cycle rotary converters, installed, new, per kw	18.00

The estimated cost of interconnection construction and changes in equipment for the plants in Group 1 is as follows: Switching and metering equipment, $48,500; step-down transformers, $152,000; rotary converters and frequency changers, $188,550; underground construction, $436,431; overhead construction, $176,500; total, $1,001,981.

These costs are based upon 1918 estimates and quotations, among which the data given in Table I are of general interest from the unit standpoint.

For the plants in Group 1 at Quincy (Electric Light & Power Company), Braintree, Weymouth, Taunton, Fall River and New Bedford, it is estimated that 29,300 kw. in transformers would be required, at an estimated cost of $94,100 and of $59,900 for installation and equipment, or a total of $154,000 for this apparatus in place. The frequency changers, it is estimated, would cost $90,000 for the apparatus and $22,500 for installation and metering and switching equipment. In the railway substations of Group 1 10,050 kw. in rotary converters would be required at an estimated cost of $59,325, $16,725 being added for installation.

The above tabulation yields a total maximum generating capacity on the two-hour basis of 228,350 kw. in 1918 and a sum of maximum loads estimated for the 1918 peak as 171,300 kw., leaving an excess capacity at the maximum load period of 57,050 kw. Holding back 30,000 kw. for reserve spare capacity, the interconnected plants of Group 1 would then have 27,050 kw. spare capacity available for sale on the 1918 estimated combined peak, and at $80 per kilowatt this means a release of generating capacity valued at $2,164,000 by the interconnection program for the plants of Group 1. At 15 per cent fixed charges on this excess capacity, there would be $324,600 to be carried. The estimated decrease in fuel consumption in the plants of Group 1

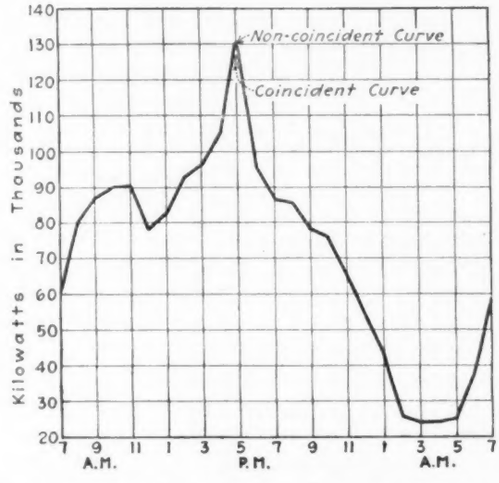


FIG. 5—COMBINED LOAD CURVES OF ELECTRIC SYSTEMS SOUTH OF BOSTON FOR 1917

TABLE II—LOAD DATA OF PLANTS

	Max. Generator Rating (Kw.) Two Hours, 1918	Max. Continuous Rating (Kw.) 1918	Economical Continuous Rating (Kw.), 1918	Max. Load (Kw.) 5 p.m. Dec. 13, 1917	Time of Yearly Max. Load	Estimated Max. Load (Kw.) of Dec., 1918
Boston Edison	145,000	115,000	100,000	83,781	Dec. 13, 4:50 p.m.	100,000
Quincy Electric Light	2,600	2,600	.....	1,500	Mar. 6	2,500
Bay State Street Railway, Quincy	15,000	15,000	12,000	12,000	.....	15,000
Braintree	450	450	.....	400	.....	400
Weymouth	1,500	1,200	.....	1,200	Aug. 4, 8 p.m.	1,400
Brockton	15,000	12,000	10,000	6,400	Nov. –4:15 p.m.	11,000
Taunton	3,800	2,500	.....	2,650	.....	3,000
Fall River	15,000	11,000	11,000	9,250	Dec. 17, 4:55 p.m.	13,000
New Bedford	28,000	26,000	25,000	17,150	Dec. 13, 5 p.m.	25,000
Plymouth	1,000	1,000	.....	Included in New Bedford.		
Buzzards Bay	1,000	1,000	.....	Included in New Bedford		

totals 37,583 tons, or $300,664 at $8 per ton. Deducting 15 per cent fixed charges on the new investment required for the Group 1 interconnection ($1,001,981), or $150,297, from the value of fuel saved, there appears a net saving on fuel alone of $150,367 on the estimated 1918 output. There also would be a very large but as yet undetermined saving in labor. Putting the results of the program in another way, it may be said that by an expenditure of $1,001,981 spare capacity in generating plants conservatively valued at $2,164,000 can be released for active service and future expenditures for new plant of an equivalent amount avoided, as well as the fixed charges for such an investment. As was pointed out in the previous article in the ELECTRICAL WORLD, the saving in fuel alone would be sufficient to retire the new investment in ten years.

The inclusion of the stations in Group 2 adds 500 kw. more to the available reserve capacity but with no material increase in the net results, either as regards increase in capacity or in fuel saved. It is doubtful if the expenditure required for this group is justified by the results in sight, and owing to their character it appears desirable to deal with these Group 2 plants individually and in connection with local conditions.

A further study of the distribution of energy between the plants in Group 1, if interconnected, indicates that at least 60,000,000 kw.-hr. would be handled the first year, this being an increase over the amount previously estimated, viz., 53,636,000 kw.-hr. This increase, it is estimated, would be derived from increased business in the Quincy and Taunton districts in excess of the original estimate and from the service supplied to certain generating plants which would not be operated so long as previously estimated. By 1919 it is probable that 80,000,000 kw.-hr. would be handled by the interconnected lines.

THE ADVANCING COST OF CENTRAL-STATION LABOR

Figures Showing the Percentages of Increase Over January, 1910, Classified According to Employment and Department

In a recent hearing held by a public service commission to consider the fairness of a proposed rate increase the estimated advances in operating expenses were substantiated by schedules showing the increasing cost of labor. This schedule, covering the more standardized positions on the central-station pay roll, is here presented as a table of percentages, indicating increases over the base rates existing in January, 1910. Although the rates paid in corresponding positions vary in different sections of the country and in cities of different classes, it is believed that the percentages are fairly representative of the advances which the average central station has been called upon to meet.

Obviously, as these statistics are drawn from the experience of a single company, certain discrepancies appear where wages are influenced by peculiar local conditions. In some cases the trend of the scale is affected by particular employees. However, it is believed that the result is fairly indicative of the rise in labor costs.

Certain points are noticeable. The standardized skilled laborers have experienced wage increases which have been fairly constant throughout the past eight years. On the other hand, common labor advanced slowly at first, experiencing but little gain during the years of building expansion (1911-1912), when skilled labor went ahead rapidly, but forged to the front with the general labor shortage following the war boom. Semi-skilled labor (helpers, such as fitters', blacksmiths', carpenters', masons' helpers, etc.) has naturally followed unskilled labor. However, whereas in 1910 such helpers usually received laborer's pay, at present they seem to have forged definitely ahead of those entirely unskilled and are rapidly becoming a class of their own.

This table of percentages is based entirely on weekly or monthly rates of pay, and does not take into consideration decreases in hours of work. There has been a decrease of one hour per day applying to many of the classifications listed.

TABLE OF PERCENTAGES SHOWING INCREASE OVER BASE RATES EXISTING IN JANUARY, 1910

Position	Jan., 1911	Jan., 1912	Jan., 1913	Jan., 1914	Jan., 1915	Jan., 1916	Jan., 1917	Jan., 1918	June, 1918
Steam plant:									
Shift engineers	0	0	10	10	15	15	15	25	30
Oilers	20	40	40	40	50	50	70	80	100
Firemen	14	14	14	14	14	21	21	29	43
Coal passers	12	25	25	25	25	25	25	37	50
Boiler cleaners	7	7	14	14	21	43	43	50	57
Cleaners' helpers	12	25	25	25	25	25	37	62	62
Steamfitters	17	17	17	17	33	33	42	67	73
Fitters' helpers	12	12	12	12	12	12	12	22	55
Station wiremen	14	14	14	14	28	28	28	36	43
Distribution system:									
Inspectors	13	13	13	33	50	50	60	67	80
Crew foremen	12	25	25	25	25	25	25	31	37
Linemen	7	14	14	14	28	28	28	36	43
Apprentice linemen	0	25	25	25	25	50	50	63	63
Groundmen	12	12	12	25	25	25	25	37	62
Inside wiremen	7	14	14	14	28	28	28	36	43
Cable splicers	6	11	11	11	22	22	22	27	34
Splicers' helpers	7	14	14	14	28	28	28	36	43
Patrolmen	11	11	11	11	14	14	28	33	39
Substation operators	11	11	11	14	28	28	33	39	33
Trimmers	8	15	23	23	38	38	38	54	69
Metermen	9	18	36	36	45	45	45	54	63
Meter helpers	10	10	10	20	20	20	20	30	40
Laborers	..	12	12	12	12	12	25	37	50
Engineering department:									
Draftsmen	8	17	25	30	40	40	40	50	67
Clerks	0	8	17	17	17	30	40	54	58
Transitmen	0	8	8	33	42	42	58	67	67
Rodmen	0	11	11	44	44	55	55	55	67
Repair shops:									
Blacksmiths	9	9	18	27	45	45	45	45	55
Blacksmiths' helpers	11	11	11	11	11	22	34	44	56
Carpenters	14	14	14	29	29	29	29	37	37
Carpenters' helpers	11	11	11	11	11	22	34	44	55
Masons	18	54	54	69	69	69	69	85	108
Masons' helpers	12	25	25	37	37	37	37	50	63
Painters	10	20	60	60	60	60	60	60	70
Painters' helpers	12	12	12	25	25	25	25	37	62
Machinists	10	30	30	40	40	60	60	92	92
Garage mechanics	8	8	20	33	58	58	58	75	75
Washers	12	12	12	25	25	25	25	37	80
Chauffeurs	0	13	33	53	53	53	53	67	67
Truck drivers	0	13	33	33	33	33	55	55	78

In order to determine general averages of increased labor costs, eliminating variations due to changes in conditions or extension of plant, the average number of each listed classification employed at present was used as a basis and the total pay roll for a month was figured for January, 1910, January, 1914, and June, 1918, using the unit rates applying to each period. It was found that labor costs for January, 1914, indicated an increase of 21.6 per cent over January, 1910. June, 1918, shows an increase of 53.6 over January, 1910, and an increase of 26.2 per cent as compared with January, 1914.

Application of Printing-Press Motors

Major Features Needed in Motors and Control Apparatus to Meet Requirements of This Service—Typical Motor Data—Semi-Automatic Direct-Current and Alternating-Current Control and Full Automatic Control

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THE choice, installation and operation of motors for driving the presses and other machinery in printing plants and the equally important items of proper control for such motors form an interesting field for the attention of the motor application engineer. The marked development of electrical equipment for the printing industry is shown by the many installations, both of belted and direct-connected motor drives, and also by the adequate means for accomplishing the specific results in the control of such apparatus both by semi-automatic and by full-automatic control equipment.

TYPES OF MACHINES INVOLVED

In addition to the printing presses of the various types, the motor is also widely used for composing machines, folders, cutters, stitchers and binding machinery in the book and job printing establishments, and for such cases as matrix and plate-making machines, paper hoists, conveyors, exhaust fans and the like in the newspaper printing plants. In practically all of these cases the motor application problem is relatively simple, except perhaps for printing presses and folders, but in the former particularly the motor problem is of considerable importance and involves factors which require due care if the best results are to follow.[1]

Printing presses may be divided into three classes—job presses, cylinder presses with a flat bed, and rotary presses. The tendency in motor control is toward automatic or semi-automatic equipment which may take the form of push-button stations. In job presses the inertia is the element which determines the motor torque requirements, the steady running conditions corresponding to about one-half the power necessary for starting. Where reciprocating motion is involved, as in flat-bed cylinder presses, a belt connection between the motor and press is usually favored.

A common method used in the control of printing-press motors is to employ part armature resistance and part field control. Thus Carpenter[1] gives the following figures for job presses, namely, a speed reduction of about 40 per cent below normal by armature resistance and a speed increase about 25 per cent above normal by field control, accomplished by the so-called "predetermined speed-adjusting and self-starting" controller, which, in standard equipments, also has a self-contained service switch for purposes of starting and stopping.

Values given for other presses are 35 per cent speed variation by field control and 50 per cent by armature resistance for cylinder presses of the flat-bed type, and 50 per cent by field control and 40 per cent by armature resistance for rotary presses. For these larger presses push-button stations are particularly useful, and they are designed to include positions for stopping, running and for "inching," this last term applying to the operation of coaxing along the press when "making ready" for printing, for washing up, and for similar requirements.

MOTOR DATA

Power requirements of printing machinery have been reduced to elaborate tabulations in complete form for ready reference by most of the manufacturers. Such tables for job presses are based on the inside dimensions of the press "chase" and the maximum number of impressions per hour. Thus a press having an 8-in. by 12-in. (20.3-cm. by 30.5-cm.) chase and making 2800 impressions (maximum) per hour calls for a ¼-hp. motor to take care of starting conditions. Similarly, a 17-in. by 22-in. (43.2-cm. by 55.9-cm.) chase and 1700 impressions per hour calls for a 1-hp. motor.

With the flat-bed cylinder press the size of the bed and number of impressions are made the basis for power requirements, while with a rotary lithographic press the size of the sheet and the number of impressions are used. However, figures of this kind give merely the horsepower requirements and to this extent are incomplete. Consideration must also be given to the mechanical characteristics of the press and the type of motor best suited to meet these conditions.

Other tabulations of a more complete nature are available from motor manufacturers. A few specially selected examples from a large mass of data collected by the Crocker-Wheeler Company[1] are shown in Tables I, II, III and IV, the last two cases referring to machinery other than presses. In a general way, it may be stated that the small size of the motors in these tables is no indication of the importance of electric drive in the operations involved. The symbol I. P. H. used in these tabulations refers to the number of printed impressions made per hour by the press, Table I giving both maximum and minimum values.

TYPES OF MOTORS

Standard direct-current motors for small job presses are usually compound-wound so as to meet the demands for heavy starting torque, common sizes ranging from ⅛ hp. upward. In the very small sizes for certain applications, like stitchers, such motors may be connected to the line directly without auxiliary starting resistance. One manufacturer who has specialized in printing-press motor equipment lists ⅛-hp. motors at 1700 r.p.m. for small job press work, proof presses, sewing machines and stitchers. For ¼ hp. the speed is rated at 1100 r.p.m.

For work involving medium or high speeds, that is, 1150 up to 1700 r.p.m., where constant-speed operation

[1] Various sources of information have been drawn from in the preparation of these notes, including a paper on "Printing Presses," *Transactions A.I.E.E.*, Vol. 34, Part I, p. 1314, by W. C. Yates; bulletins, data and illustrations from the Sprague Electric Works of the General Electric Company, Westinghouse Electric & Manufacturing Company, Crocker-Wheeler Company, Wagner Electric Manufacturing Company and Reliance Electric & Engineering Company. A number of references have also been made to an article on this general subject by C. E. Carpenter, "Standard Handbook for Electrical Engineers," fourth edition, page 1275.

by armature control is desired, or where adjustable speed up to say 25 per cent with field control meets the conditions, this same manufacturer lists the commutating-pole direct-current motor from ½ hp. at 1700 r.p.m. upward.

A round-type direct-current motor is also commonly used for printing-press applications and has proved of considerable value. Among its characteristics are its heavy construction, high efficiency, inclosing frame, wide speed adjustment and a large overload capacity. This type is available in capacities which range from ⅛ hp. at 750 r.p.m. up to 5 hp. at 1150 r.p.m. It is particularly suited for binderies, where its inclosed construction is an advantage.

TABLE I—DATA ON TWO, THREE AND FOUR-ROLLER PRINTING PRESSES

Press No.	Bed	I. P. H. Max.	I. P. H. Min.	Press Ratio	R.p.m. Max.	Shaft Min.	Press Pulley	Hp. Required
			"Optimus" Two-Roller					
3	26 x 32	3000	1500	5.68:1	284	142	24	1½
4	27 x 39	2800	1400	6:1	284	140	24	1½
			"Optimus" Three-Roller					
4	28 x 41	2500	1250	6:1	250	125	27	1½
			"Optimus" Four-Roller					
5	30 x 43	2400	1200	7½:1	300	150	28	2
6	34 x 47	2100	1050	8:1	280	140	32	2
7	36 x 52	1900	950	9:1	284	142	32	2½
9	39 x 55	1800	900	9.6:1	288	144	32	3
10	41 x 55	1700	850	9.9:1	280	140	32	3
11	45 x 63	1600	800	10:1	266	133	32	3½
12	47 x 66	1500	750	10.57:1	264	132	32	3½

TABLE II—MOTOR DATA FOR JOB PRINTING PRESSES BASED ON THE USE OF 115-VOLT AND 230-VOLT MOTORS

Chase	Hp.	R.p.m. Motor Max.	R.p.m. Motor Nor.	R.p.m. Motor Min.	Motor Pulley	Press Pulley	Controller
			Combined Armature and Field Control				
8 x 12	.3	720	560	360	3 x 2	14 x 2	44
10 x 15	1/5	875	750	438	3½ x 2¼	12 x 2¼	44
12 x 18	2/5	900	780	450	3½ x 2¼	14 x 2¼	44
13 x 19	2/5	900	780	450	3½ x 2¼	14 x 2¼	44
14 x 20	1/2	660	550	330	4½ x 2¼	14 x 2¼	44
14½ x 22	1/2	660	550	330	4½ x 2¼	14 x 2¼	44
			Combined Control and Friction Drive on Flywheel				
Chase	Hp.	R.p.m. Motor Max.	R.p.m. Motor Nor.	R.p.m. Motor Min.	Motor Pinion	Flywheel	Controller
8 x 12	1/5	890	750	445	6 x 2½	32	44
10 x 15	1/4	2220	1800	1105	4 x 2½	40½	44
12 x 18	1/2	1950	1650	975	5 x 2½	40½	44
13 x 19	1/2	1950	1650	975	5 x 2½	40½	44
14 x 20	1/2	2020	1650	1010	4 x 2½	40½	44
14½ x 22	1/2	2020	1650	1010	4 x 2½	40½	44

Commutating-pole direct-current motors for flat-bed and small rotary presses are available in standard sizes of 4½, 7½, 10, 12½ and 15 hp., and are also built up to 120 hp. Speed adjustment is accomplished by field control, a speed variation of 50 per cent being permitted with medium-speed motors and 100 per cent with low-speed units for flat-bed and small rotary presses.

For newspaper and magazine rotary presses one manufacturer recommends a commutating-pole motor with speed adjustment of 2 to 1 (that is, 100 per cent) by field control. Where it is desirable to have a wider speed range than 2 to 1, and especially with one-motor equipments, a speed range as high as 5 to 1, with field control, is available.

To give some indication of the alternating-current motors that are adapted to printing-press work the operation of flat-bed and small rotary presses will be considered. Wound-rotor two and three-phase induction motors are available in sizes from ¼ hp. up, for voltages of 110, 220, 440 and 550, and for frequencies of 25, 40, 50 and 60 cycles, but for the special case of flat-bed and small rotary presses the standard sizes of one company are 1½ to 15 hp. with usual speeds of 1800, 1200 and 900 r.p.m. for 60 cycles, and correspondingly lower values on the lower-frequency circuits.

Speed adjustment in motors of this type is accomplished by varying the auxiliary rotor resistance. By their use the special requirements of printing-press operation have been met successfully, considering large starting effort, low current at starting even under heavy load, and a low temperature rise even where operation is continuous throughout the day.

For newspaper and magazine presses the slip-ring type two or three-phase induction motor is also used, although its success is due in large measure to the perfection of a completely automatic alternating-current system of control.

Single-phase alternating-current repulsion-type motors are used to some extent and are especially applicable where speed adjustment must be accompanied by approximately constant torque. This motor is well suited to small presses in sizes ranging from ⅛ to 7½ hp. and for speeds from 1200 to 1800 r.p.m. They may also be employed for fans and blowers by belt or by silent-chain connection. Speed adjustment with the repulsion-type motor is accomplished by brush shifting.

CONTROL FOR BELTED EQUIPMENTS

Turning now to control features, the older form of belted motor equipment may be mentioned. Here the motor is started with its belt on a loose pulley and hence under no load. By means of a lever-operated clutch low speed is applied to the press, and by shifting the belt to a tight pulley high speed is applied.

The motors used for this form of drive may be of the adjustable or constant-speed direct-current or alternating-current types. The direct-current motors may be controlled by a hand-manipulated speed-regulating panel, and alternating-current motors either by a drum-type or a dial-type controller. Convenient mountings of these control devices for printing presses have been worked out.

TABLE III—MOTOR DATA FOR CUTTERS BASED ON THE USE OF 115-VOLT AND 230-VOLT MOTORS

Size	Cutter Flywheel Dia.	Cutter Pulley Dia.	Cutter Pulley Face	Cutter Pulley R.p.m.	Motor (Compound) Hp.	Motor (Compound) R.p.m.	Motor (Compound) Pulley Dia.	Motor (Compound) Pulley Face
30"	21½"	14"	2.75"	200	1½	900	3"	3½"
33"	23½"	14"	3¼"	200	1½	900	3"	3½"

TABLE IV—MOTOR DATA ON FOLDING MACHINES

Folder Data Pulley	Folder Data R.p.m.	Motor Recommended Hp.	Motor Recommended R.p.m.	Motor Recommended Pulley
10½ x 3	135	¼	550	.....
6¼ x 3	200	½	550	2½ x 3
8 x 3	300	1	780	3.2 x 3
6¼ x 3	300	1½	850	2.4 x 3
10 x 3	400	2	1175	3.4 x 3
6¼ x 3	294	1	780	2.6 x 3
8 x 3	360	1½	850	3.4 x 3
8 x 3	360	1½	850	3.4 x 3
8 x 3	300	1	780	3.1 x 3
8 x 3	420	1½	850	4 x 3
8 x 3	546	1½	1250	3.5 x 3
8 x 3	546	1½	1250	3.5 x 3
8 x 3	546	1½	1250	3.5 x 3
8 x 3	258	1½	850	2.4 x 3
6¼ x 2½	120	½	550	.....
6¼ x 2½	210	1	550	2.6 x 2½
10 x 3	420	2	1175	3.6 x 3

One manufacturer's equipment for semi-automatic direct-current control consists of a two-motor driving equipment, a master dial switch, a controller panel and resistance and push-button stations. By these means it is possible to start, to "inch," to run at a low speed and to stop the press at any one of the push-button stations. It is interesting to note certain aspects of this form of printing-press control.

To increase or decrease the press speed the handle of a master dial switch, mounted on the side of the press, is turned. The various steps of armature resistance are inserted or removed by contactor switches on the control panel. These, in turn, are operated by push buttons on the dial switch. The dial switch is also used to insert or reduce the auxiliary field control resistance. Current-limiting relays prevent too rapid acceleration of the press by wrong handling of the dial switch, so that this system possesses some of the

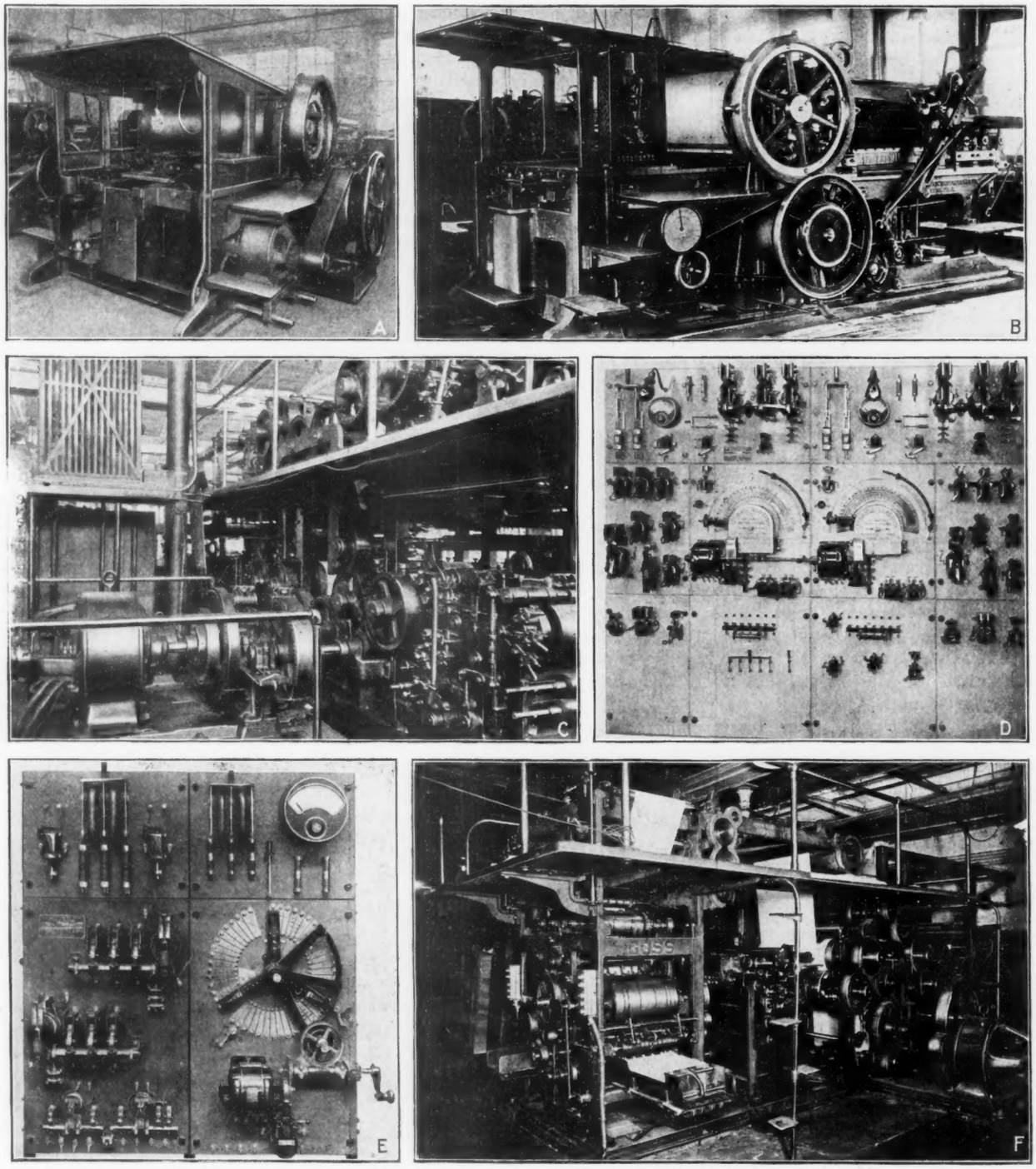
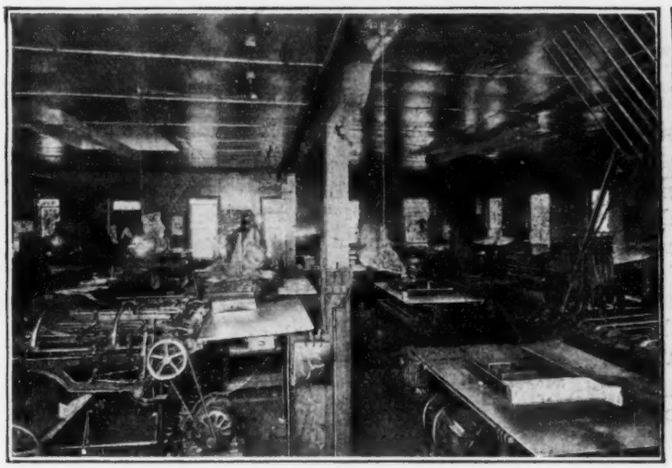


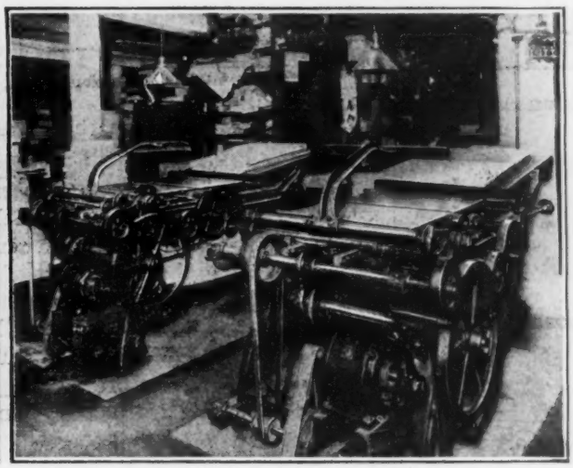
FIG. 1—MOTOR AND CONTROL APPLICATIONS FOR PRINTING PLANTS

A—Printing-press belt operated by direct-current motors. B—Adjustable-speed motor, 6 hp., 600 to 1500 r.p.m., equipped with automatic starting control and speed dial applied to a 43-in. by 56-in. printing press. C—Example of direct-current motor-drive for the operation of cylinder printing presses (note mechanical connections). D—Complete automatic controller for four-motor printing press. E—Panels for full automatic double-motor printing-press control. F—Cylinder press driven by direct-current motor and controlled by push-button stations.

features of the completely automatic control system described below.

The alternating-current two-motor semi-automatic control system is used in sizes ranging from 15 to 100 hp. and is applicable to newspaper and rotary magazine presses. Here also the controller is of the dial type. and push-button stations are employed in connection with it. By means of properly graduated controller steps it is possible to adjust the press cylinder speed from say 10 revolutions per minute up to 200 r.p.m. to 300 r.p.m.





FIGS. 2 AND 3—POLYPHASE MOTORS FOR PRINTING-PLANT OPERATION; PRINTING-PLANT FOLDERS BELT-CONNECTED WITH DIRECT-CURRENT MOTORS

The practical operation of one semi-automatic system extensively used for either direct-current or alternating-current motors may be best explained by the following details. The push buttons are in groups of four, the buttons marked "Jog," "Stop," "Safe" and "Run" respectively. Pushing the "safe" button prevents starting until the "run" button at that same station shall have been closed.

With the controller at the off position, the "jog" button may be pushed for inching along the press by fine movements. The same "jog" button, if closed with the controller at its "slow" position, starts the press and operates it at low speed. The "stop" button, when closed, stops motor and press. For an increase or decrease of speed the controller must be hand-operated. When the equipment is stopped for any reason, the controller must be placed at its off position before starting is again possible. No-voltage and overload protection are employed.

FULL-AUTOMATIC CONTROL SYSTEM

One "full-automatic" control system on the market possesses the feature of being entirely automatic through push buttons. Each push-button station has five buttons, but as many stations as desired may be used. The five buttons are marked "Jog," "Fast," "Slow," "Safe Stop" and "Run," and the successive features of operation are as indicated in the paragraphs that follow:

Closing the "safe stop" button at any station prevents starting from any of the stations until the "run" button at this particular station is closed. This is an important protective feature. "Inching" or jogging the press along is accomplished by the so-called "jog" button, the press moving only as long as this button is held closed and stopping as soon as it is released.

The "fast" button starts and accelerates the press, acceleration continuing gradually as long as this button is held closed. On releasing the "fast" button the press then continues to run at the speed attained just before the button was released. Similar operation with decreasing speeds follows the closing of the "slow" button. Immediate stopping is brought about by the "safe stop" button. This scheme is designed to be fool-proof and accident-proof and represents a notable development in automatic control practice.

Examples of printing plant motor and control applications are shown in accompanying illustrations.[2]

[2]Figs. 1D and 1E are due to the Sprague Electric Works of the General Electric Company; Figs. 1A, 1C, 1F and 3 to the Westinghouse Electric & Manufacturing Company; Fig. 1B to the Reliance Electric & Engineering Company, and Fig. 2 to the Wagner Electric Manufacturing Company.

The [motor-truck] manufacturers and dealers fully realize that steel is to-day the world's most needed metal and that, in view of the urgent war demands of this nation and its allies, it is well-nigh treasonable to consume a pound of it that can be saved. With this in view, the manufacturers and dealers pledged themselves to reverse their practices of normal times, and, instead of selling through solicitation as many trucks as possible and furnishing new trucks to replace old ones, to use their utmost endeavor to induce owners and operators to repair and use the trucks they have as long as possible, to operate them fully loaded, and through shifts of drivers and otherwise to keep them in use during the greatest possible portion of each day, to the end that each unit shall perform a maximum of service and thus reduce proportionally the necessity for building new trucks.—*War Industries Board.*

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

INTELLIGENT INSPECTION PREVENTS POWER-HOUSE LOSSES

Man Added to Station Force to Report Necessary Repairs to Chief Engineer and See that Repairs Are Made

Periodical inspection of power-house equipment can be made a profitable power-house practice. An especially thorough inspection of equipment taken out of service for repairs should be insisted on, in the opinion of J. M. Strike, chief engineer of the Acme Power Company, Toledo, Ohio. This system has been tried out by William Long, superintendent of production of the Toledo Railways & Light Company, and has proved so successful that a boiler inspector was added to the permanent organization. His duties are to inspect all boilers and boiler equipment and to report the necessity of repairs.

MAINE COMPANY STATES ITS POTHEAD PRACTICE

Finds Potheads Useful and Economical on Both Overhead and Underhead Circuits—Save Money at Railroad Crossing

For both overhead and underground construction the Central Maine Power Company has found it pays to use disconnecting potheads. On pole lines they are installed even with the cross-arm, using the terminal bushing, which can be disconnected. They were selected for this particular purpose on account of their neat appearance and the flexibility they permit. On lines leaving power houses they are particularly adaptable, giving a wide range of choice in arranging feeder circuits coming from the switchboard by way of underground ducts and up the side of the pole. This method of construction has been found to require less building material and fewer cross-arms and insulators than are needed by the old method of carrying the feeder circuits out through the side of the building to the pole line.

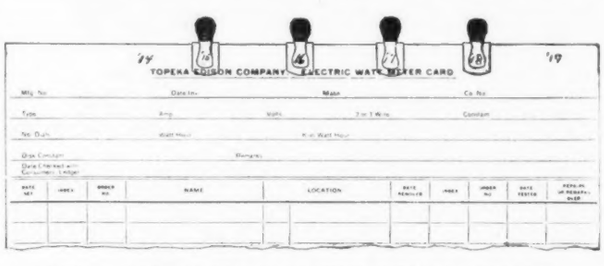
A typical case in which potheads were used to help solve a railroad crossing problem occurred at Waterville, Maine. The company there has a four-wire three-phase distribution line on 35-ft. (10.7-m.) poles. On account of a new overhead railroad bridge being built across the highway, it was necessary to remove the wires from their established places. To do this the company could either use 65-ft. (19.8-m.) poles to go over the track with the proper clearance or go underneath the track with underground cable. After figuring all expenses, it was found to be 20 per cent cheaper to dead-end the line at each side of the bridge and use 110 ft. (33.5 m.) of four-wire No. 2 5000-volt armored cable with potheads on each end, mounted near the cross-arm on each dead-end pole. This plan had the further advantage of placing the cable about 2 ft. (61 cm.) below the surface of the road, out of the way for all time. On this installation as well as on other similar jobs the company has always found it necessary to install lightning arresters very close to all cable terminals.

The company finds another use for potheads when supplying large power customers with 2200-volt service. On such jobs the circuits are put underground on the customer's property, and brought up directly at the customer's private distribution station to avoid all liabilities from high-tension wires on private property.

MAKING METER-DEPARTMENT RECORDS EASY TO HANDLE

Status of Test Work Is Shown at a Glance by Signals Attached to the Top of the Cards—Simplicity of Method Recommends It

Meter records of the Topeka (Kan.) Edison Company are kept on 5-in. by 8-in. (12.7 to 20.3 cm.) cards, one side of which carries the usual data concerning the rating of the meter and the locations it has occupied



METER INFORMATION CARD WITH SIGNALS ATTACHED

during its life, while the other side gives space for information regarding its accuracy when tested. In order to make it easy to pick out the cards of meters which should be tested, signals are attached to the tops of the cards. The signals consist of paper clips made by the B. Graff Company of Boston. One of these is attached to each card in one of four positions, indicating when the meter was tested. One position means 1915, another 1916, another 1917 and another 1918.

Thus, when it is desired to test meters, it is easy for the department head to go through the file and pick out the cards of the meters that should be tested, and from these cards to make up a route for the testers to follow.

Some difficulty has been experienced in making the cards stand straight in the card file, because the signals make the cards thicker at the top than at the bottom. This trouble has been reduced considerably, however, by bending heavy pieces of galvanized iron to the shape of an inverted V and standing them in the drawers.

GRAPHICAL SOLUTION OF ILLUMINATION PROBLEMS

Flux-of-Light Method for Constructing Chart from Which Number of Lamps for Different Installations May Be Determined

BY N. S. DICKINSON
Newark (N. Y.) Technical School

To determine the number and size of lamps required to light a room effectively the chart shown in the accompanying illustration has been developed by the author. With the dimensions of the room, nature of ceiling and walls—that is, light or dark in color—and the kind of work to be performed in the room known, it is an easy matter to find the number of lamps of any size needed. An example worked out (Fig. 1) illustrates the ease with which the problem can be solved.

The four-quadrant diagram of Fig. 2 shows the method by which the diagram was evolved. Its construction is based on the formula that: Number of lamps = (area of horizontal plane × efficiency) ÷ (utilization factor × light flux per lamp). The graphic method is facilitated by the fact that all terms of this equation are of the first degree. The lines in quadrant 2 (Fig. 2) are drawn for 55, 50, 45 and 40 per cent utilization factors using direct lighting units. Their assumed equivalents for semi-indirect lighting are 37, 33, 30 and 27 per cent respectively, as indicated in the right-hand vertical scale of Fig. 1. The compact arrangement obtained in Fig. 1 is constructed from Fig. 2 by placing all of these straight-line curves in the first quadrant.

Standards of the Illuminating Engineering Society

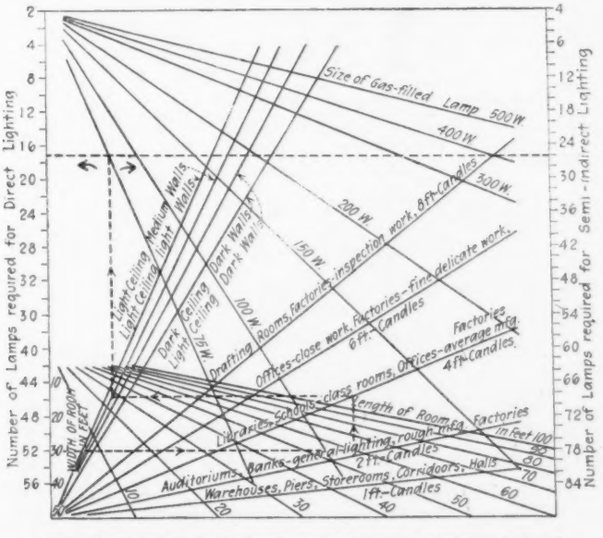

Number of Lamps required for Direct Lighting
Number of Lamps required for Semi-indirect Lighting
Size of Gas-filled Lamp 500W.
400W.
300W.
200W.
150W.
100W.
75W.
Light Ceiling, Medium Walls
Light Ceiling, Light Walls
Dark Ceiling, Dark Walls
Dark Ceiling, Light Walls
Drafting Rooms, Factories-inspection work, 8 Ft.-Candles
Offices-close work, Factories-fine delicate work, 8 Ft. Candles
Factories, Offices-average req., 4 Ft.-Candles
Length of Room in Feet
Libraries-schools-class rooms, Offices-general lighting, rough work, Factories, 2 Ft.-Candles
Auditoriums, Banks-general lighting, Factories, Storerooms, Corridoors, Halls, 1 Ft.-Candles
Warehouses, Piers, Storerooms, Corridoors, Halls, 1 Ft.-Candles
WIDTH OF ROOM IN FEET

FIG. 1—CHART FOR SOLVING ILLUMINATION PROBLEMS

Assuming that it is desired to light a room 30 ft. (9 m.) by 60 ft. (18 m.) which has a ceiling light in color and medium walls, and which is to be used for general office work, the following procedure is carried out: From the 30-ft. (9-m.) mark on the "Width of Room" move horizontally to the 60-ft. (18.-m.) "Length of Room" line (follow dotted line), then vertically upward to line marked "Offices," again horizontally to line "Light Ceiling, Medium Walls," and then upward to size of lamp lines. If a 75-watt lamp is used, the number of direct or semi-direct units is determined from the scales in the left-hand and right-hand sides of the chart respectively.

were used in selecting the illumination requirements for various installations. Light flux in lumens for different type lamps was taken from the Data Book, Schedule 1, Edison Lamp works.

Bowl-frosted or half-frosted lamps should always be used for direct lighting installations, unless the lamps are mounted more than 15 ft. (457 cm.) above the floor, and even then they are preferable. Contrary to the general opinion, bowl frosting reduces the useful light flux

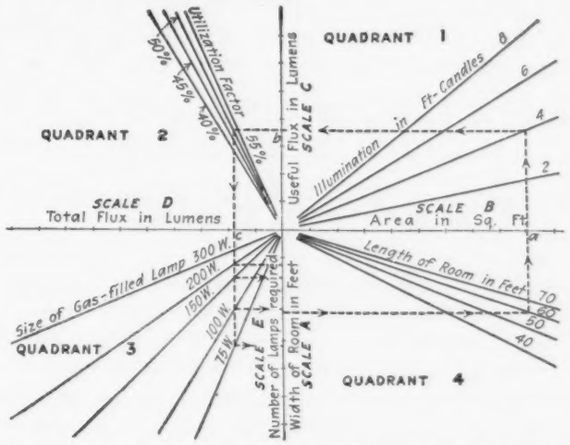


FIG. 2—CHART DRAWN IN FOUR QUADRANTS FROM WHICH FIG. 1 IS DERIVED

not more than 5 per cent or 6 per cent. The reduction of glare effected by their use more than compensates for the slight loss of light flux, and therefore really produces more comfortable and effective lighting conditions.

The recommendations of the manufacturers should always be carefully followed when selecting reflectors for an installation, as it is important to obtain a type and size of reflector designed for the spacing, mounting height and size of lamp to be used.

DRIVING POLE STUBS WITH A MOTOR TRUCK

Pile Driver Made in Telephone Company's Shop with Which Stubs Were Driven at a Cost of Six Dollars per Pole

An important toll lead between Los Angeles and Long Beach, on the system of the Southern Division, Pacific States Telephone & Telegraph Company, had been seriously damaged by flood waters. On this account, and also because of the silty nature of the soil, plans had been made to abandon the line for another route. The construction department, however, developed and successfully carried out a plan for reinforcing the existing lead with pile stubs.

The equipment used consists essentially of a pile driver having guides which could be attached to the pole to be reinforced. The hammer, made of concrete, was raised in the guides by means of a steel rope which was operated from a winch mounted on a motor truck and driven by the automobile engine. Piles 18 ft. (5.5 m.) in length were driven to a depth of 14 ft. (4.3 m.) alongside the poles and the poles secured to these stubs in the usual manner. The labor cost per pile driven was $6. The lead was thus made safe at about 10 per cent of the cost of a new line, and the net saving was approximately $7,500. The cost of the hammer and guides was $35.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

RECORD FOR APPLIANCE SALES IN DOHERTY ORGANIZATION

Figures Received for First Six Months Indicate that the Total for 1918 Will Exceed $2,500,000

The sales of gas and electric appliances by the new-business departments of the Doherty Organization for the first six months of 1918 indicate a large rate of increase, as shown by the following comparative table:

Year	Sales Value	Year	Sales Value
1914	$396,110	1916	$1,224,390
1915	694,363	1917	1,870,000

	Sales Value
Six months, 1918	$1,073,696
Six months, 1917	769,885

Estimating the remaining six months of 1918, it is expected the total for the year will exceed $2,500,000.

UTILIZING SURPLUS CAPACITY OF WATER-WORKS STATION

Features of Contract Securing for Utility 225 Kva. of Energy Without Involving Capital Expenditure

The enormous demand for power upon central-station companies has presented a problem to operators which it is becoming increasingly difficult satisfactorily to meet. The exigencies of war have not only made it imperative that central stations shall utilize every possible piece of generating apparatus which they can obtain but many of them are also supplying their newly acquired power users by means of purchased energy. In the past year many lines have been constructed for the interchange of energy between central stations in adjacent cities. Many contracts have been entered into between central stations and large industries manufacturing their own electrical energy for use by central stations of every kilowatt over and above the needs of the industry concerned.

Another interesting phase of the situation, which will possibly be a partial solution of the difficulties of some central stations, has now come to light through arrangements being made by the utility companies for the purchase of energy from municipalities operating their own waterworks systems. A contract of this nature lately entered into in a Middle Western city of the 25,000 population class calls for the purchase of the entire output of electrical energy generated by a 225-kva. generator over and above the pumping requirements.

Under the terms of the contract the waterworks bind themselves to furnish such electrical energy at all times, and the company to receive and pay for such energy to the extent of its demands for a period of three years; and provision is made that if during the term of the contract the waterworks shall have any additional electrical energy for sale the company shall have the option to purchase it at the same rate and under the same terms as provided in the contract for the purchase of the energy generated by the 225-kva. generator.

The rate provided to be paid by the company to the waterworks for the electricity so purchased is somewhat in excess of the actual cost of generation by the company's own generators, but the advantage of having an immediately available supply of electrical energy for war-time demands outweighs this small difference.

Provisions are made, of course, for the accurate measurement of energy received by the company under the contract and for rebating pro rata to the party suffering from any inaccuracy discovered. The contract further provides that during the life of the contract the company shall not be required to pay the waterworks for electrical energy purchased so long as the city is indebted to the company for street-lighting service, and that in the event of the city paying the company for its street-lighting service in scrip or warrants the waterworks will accept such scrip or warrants at full face value in payment for electrical energy purchased by the company from the waterworks.

The contract for the purchase of this energy was made conjointly with the renewal of the street-lighting contract existing between the city and the company. It provides the waterworks with a means of disposing of excess electrical energy generated at a profit and gives the company a reserve supply of power which it so much needs.

CHARGING $1 OR MORE FOR RECONNECTION IS FAVORED

Labor Scarcity and Tight Money Lead Central-Station Managers to Drastic Treatment of Slow Payers and Vacationists

Among central stations of the Middle West there is a growing tendency to enforce more strictly rules concerning a charge for reconnecting a customer's service when it has been disconnected for non-payment or other causes. The general policy seems to be to make a charge of $1 for this reconnection. There are some managers, however, who favor increasing this amount to $2. Strict enforcement of this rule is said to do much to cut down unnecessary labor charges incident to disconnecting in order to collect money and reconnecting after payment has been made. A firm policy on this matter has the further advantage of making collections easier and payments more prompt. This latter feature is considered important under prevailing financial conditions.

Among those who favor the two-dollar charge are some who have many customers that ask for discon-

nection during the summer months while they are away from their city residences. It is figured that if the company has its investment in lines, transformers and meters for these customers idle during the summer months, more than a reconnection charge of $1 should be made for the periodic discontinuance of service.

ROUND-TABLE DISCUSSION OF LABOR PROBLEM IN IOWA

Central-Station Men Give Opinions on Increasing Wages with Some Data on Power-House Labor Prices

One of the features of the recent convention of the Iowa Section of the National Electric Light Association was the discussion of the labor situation. This brought out with great clearness the serious trouble with which the public utilities of Iowa, and of the entire Middle West as well, are confronted. Mr. Hamlin of Mason City said that while labor in his city was not unionized, a sense of fairness had made it necessary to raise the wages of all employees. Men must be paid enough wages to enable them to meet their bills. It is simply a matter of getting together with the men and figuring out in each case what they can get along on. The real labor problem is not "Shall we advance wages?" but, rather, "How much shall we advance them?" Utilities would appreciate this fact better if they looked more closely into the cost of labor turnover. When all the items pertaining to the expense of training men are considered, it will easily be seen that it is better to pay an old employee a little more and retain him than to let him go and fill his place with a man at the same price or a little less. At the same time, an intelligent employee should be made to see that steady work at a job in an essential industry would be better for him in the long run than frequent short jobs in industry temporarily prosperous during the war.

W. H. Abbott of Omaha, who is connected with plants operating in small towns where no labor organizations exist, related an experience in one town where the power-house labor got together and threatened to shut down the plant if an exorbitant wage were not paid. The situation was solved by presenting the facts to the local representative of the State Council of Defense. The chairman of this committee took the situation in hand, telling the men that their act was in fact treasonable, as they were shutting down an essential industry in war time. The men went back to work, and wages were later adjusted. In the fifty properties served by the company which Mr. Abbott represented he stated that it had been the policy to give the employees a large number of small wage increases rather than a fewer number of larger raises. He pointed out that the recent wage increases granted railroad employees by the government had made the continuance of this policy difficult, as the establishment of the railway wages gave employees a definite mark to aim at and made their demands more insistent.

Speaking on methods of holding labor, R. E. Brooks of Red Oak said that many employees of his company are in the draft age and were placed in deferred classification on account of their employment. Under these conditions he said the men hesitate to leave the employ of the company. Nevertheless, when a man asks for an increase in wages his request is usually granted.

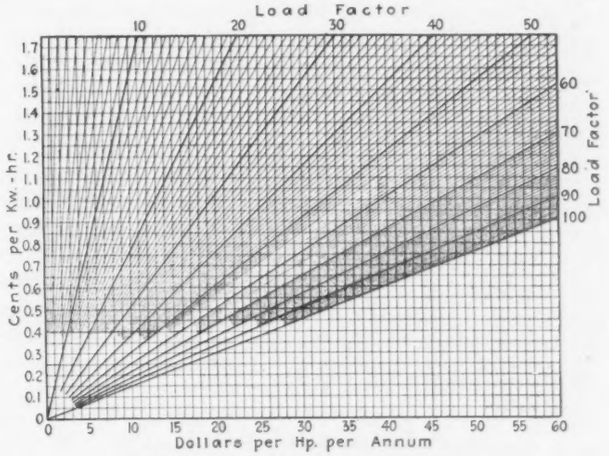
A discussion of power-house labor costs by M. G. Linn of Des Moines, R. C. Clifton of Ida Grove, G. T. Hughes of Sheldon and C. O. Ingersol of Marion brought out that the following wages are being paid: Sheldon—twelve-hour shifts, $85 per month for firemen and engineers. Red Oak—formerly eight-hour shifts for $60, recently changed to an hourly basis, because it gives the men an opportunity to do extra work and earn overtime pay. This gets the company's work done and gives the men more money. Ida Grove—firemen, $75; engineers, $85; electricians, $100. Marion—firemen, twelve-hour shifts, $75 to $80; engineers were formerly pand $85, now paid $90, and it is expected that they will have to change to an eight-hour shift.

George E. Cornelius said he was paying his engineers $100 and firemen $82.50 for twelve-hour shifts. He expressed the opinion that it was better to pay increased wages to the firemen than to lose them frequently, as a good fireman can save the company considerable money and a poor fireman can lose quite a sum for it in a very few hours.

TO DETERMINE INCOME AT KNOWN LOAD FACTOR

Chart Used by Canadian Company Makes It Possible to Know the Rate per Horsepower-Year at Any Energy Rate

The rate research committee of the Canadian Electrical Association published in its report at the recent annual convention a form of rate curve in use by one of the member companies of the association and which, the committee states, had not hitherto been published. By the use of this plan, as shown, any



CONVENIENT FORM OF RATE CURVE

rate schedule can be compared with any other rate schedule within the limits of the schedule as to price.

The lines radiating from the original are load-factor lines, and as the rate is given, the total rate per horsepower-year is immediately readable. The procedure is to trace up the known load-factor line until it hits the horizontal line corresponding to the rate for this service. The reading directly below this point will give the dollars per horsepower-year.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Indirect Construction of Rigorous Diagram for Revolving-Field Motors.—V. GENKIN.—The use of circular diagrams in the practical study of asynchronous motors with revolving field is restricted for two reasons: In the case of large motors functioning with a very small slip the diagram does not give the characteristics pertaining to normal operation with enough precision; in the case of motors of small power where diagrammatic results have great practical utility the simple form of diagram cannot be employed to advantage because of the relative importance of the stator resistance. The author describes a graphic process which permits the transformation in a very simple manner of the Blondell-Heyland-Behrend circle into a rigorous diagram which may readily be applied.—*Revue Générale de l'Electricité*, June 29, 1918.

Iron Commutators.—B. G. LAMME.—About twenty-seven years ago the writer made extended tests on the use of iron street-railway commutators. The machines soon developed "high mica" and the commutators gradually blackened, the contact surfaces blistered and sparking gradually increased until the commutating conditions became prohibitive from the operating viewpoint. It was not recognized at first that the high mica was the result of burning rather than the cause. Quite complete tests were also made with aluminum street-railway motor commutators. This material served better than iron, in the sense that burning and blackening and high mica did not appear so quickly. However, there was no tendency to polish, and the commutator soon assumed a dull appearance, which gradually changed to a blackened and burnt condition. In large machines one serious condition might be encountered with other than copper commutators. At present these machines are built for quite high peripheral speeds of the commutators, and construction difficulties are encountered which would make any increase in their length or diameter very objectionable. It is thus obvious that the use of iron in commutators, while possibly worth consideration under present or near-by conditions, is not in the direction of an advance in the art. In fact, it is a big step backward.—*Electric Journal*, July, 1918.

Lamps and Lighting

Lighting of Office Buildings.—A general discussion of lighting units and fixtures, systems of illumination and their application to local conditions.—*Electrical Dealer and Contractor*, August, 1918.

Generation, Transmission and Distribution

High-Power Central Stations.—L. CONGE.—First part of an article in which the author, recognizing the necessity of great central stations controlling electrical distribution over large regions, comments on the lack of uniformity in their arrangement and advocates standardization of equipment and lay-out. He divides high-power central stations into four classes: (1) Generating stations (usually hydroelectric) in which all the power produced is distributed at high tension to distant substastations; (2) transformer stations, where electricity received from the generating station is stopped down and distributed at medium tension to the network; (3) hydroelectric or thermoelectric generating stations distributing directly at medium tension part of the energy produced and transforming another part for transmission at high tension; (4) generating stations (usually thermoelectric) which distribute directly at medium tension all the energy produced. The principal conditions to which all these installations should respond, to the effacement of every other consideration, are, in their order of importance, reliability of service, flexibility of operation, economy, and possibility of extension. A scheme proposed for a hydroelectric generating station and an installation of step-up transformers is detailed in this installment.—*Revue Générale de l'Electricité*, June 22, 1918.

Efficient Combustion of Coal.—New and important developments in burning coal economically and the utilizing of pulverized coal are discussed.—*Journal of American Society of Mechanical Engineers*, July, 1918.

Selection of Mechanical Stokers.—The kinds of plants and coals to which different types of mechanical stokers are adapted are outlined and limitations to their use in small plants are cited. The subject is considered as follows: Reclassification of coals on ash-content basis, effect of fuel-bed disturbance, the field for the mechanical stoker, classification of stoker plants, coal classification, types of boiler plants, adaptability of stokers to different requirements, location of non-coking coals, how to burn green lignite successfully. The article also contains tables of different kinds of coals and analyses thereof.—*Journal of American Society of Mechanical Engineers*, July, 1918.

Application of the Automatic Railway Converter Substation.—C. S. BURLINGHAM.—This article discusses the essential features causing the substation to operate when power is required and to shut down when there is no demand. The equipment consists of various mill-type contactor switches on the alternating-current side, the usual remote-control alternating-current switching equipment, a few relays, a polarized motor-relay and resistances. The starting and stopping, the protective devices used and advantages of automatic substations are dealt with.—*Sibley Journal of Engineering*, Cornell University, July, 1918.

Gas Firing of Boilers.—T. M. HUNTER.—This gives a number of tables of heat losses, calorific values, composition, etc., of coke-oven, blast-furnace and producer gases in order to enable results obtained from gas-fired

boilers to be tested. The main reason for blast-furnace gas not being used with greater success is that it carries large quantities of dust, resulting in decreased evaporation and frequent cleaning of the plant. Regenerative coke-oven gas has higher calorific value than blast-furnace gas, but the efficiency is still low. It is important that gas should be dry when burned, as water vapor reduces the flame temperature and wastes a large quantity of sensible heat. The cost of cleaning gas is about 2d. (4 cents) per 35,000 cu.ft. by either the wet or dry process. Heat transference and means for improving it are discussed.—*Science Abstracts, Section B*, May 31, 1918.

Some Fundamentals of Power-Factor Correction.—R. A. MCCARTY.—The theoretical treatment of power factor correction is given with the aid of vector diagrams. The author points out the use of synchronous condensers for this service and the use of the over-excited synchronous motor with added mechanical load. Converters may only be used for power-factor correction to a limited extent on account of armature and field heating. He points out that static condensers might be used for the purpose, but this scheme has not been commercially developed to any great extent.—*Association Iron and Steel Electrical Engineers*, March, 1918.

Traction

New South Wales Government Tramways.—Details are given of track construction, types of car (which are arranged for multiple-unit operation if desired) and a unique system of route signs. Statistical information is also embodied in this article.—*Electric Railway Journal*, July 6, 1918.

Installations, Systems and Appliances

The Bocaquilla Plant.—Description of the hydroelectric power house at Bocaquilla, on the Conchos River, State of Chihuahua, Mexico. The dam is 74 m. (242 ft.) high, and the artificial lake impounded is said to be largest in the world, having an area of 175 sq.km. and a content at the 70-m. (230-ft.) level of 3,150,000,000 cu.m. (about 4,200,000,000 cu.yd.). Double Francis turbines rated at 10,000 hp. are directly connected to alternators generating 6250 kw. at 400 volts, 1130 amp. and 360 r.p.m. The energy is raised to 63,600 volts and will eventually be transmitted at 110,000 volts. The high-tension line, 76 km. (47.2 miles) in length, feeds the mining district in Parral. The electrical equipment was furnished by the General Electric Company and the hydraulic machinery by Escher, Wyss & Company, Zurich, Switzerland.—*Revue Générale de l'Electricité*, June 22, 1918 (abstracted from the *Schweizerische Bauzeitung*).

Practical Alternating-Current Problems.—WILLIAM R. BOWKER.—The writer discusses the operation of rotary converters and their interconnection with polyphase current apparatus. The most desirable methods of starting and operating are explained, the article being illustrated by schematic diagrams of connections.—*Electrical Engineering*, New York, July, 1918.

Electric Furnace for Annealing and Forging of Steel.—WIRT S. SCOTT.—To secure even moderately successful results with carbon beds it was found that resistor material must be of the purest carbon or graphite, of which it was difficult to obtain a supply sufficient for operating furnaces. When such a furnace was maintained at sufficient temperature to turn out steel at 1800 deg. Fahr. (980 deg. C.), it was found that the temperature at the bottom of the resistor bed was approximately 3600 deg. Fahr. (1980 C.). This high temperature causes difficulty in furnace maintenance. Experiments were made to determine the suitability of silicon carbide as resistor material. The decomposition of this material takes place at about 4000 deg. Fahr. (2200 deg. C.). It may be molded in block form and used in the ceiling or walls, thus equalizing furnace temperatures. The resistor has a high negative temperature coefficient. Semi-automatic control has been developed, but full automatic control is anticipated. The furnace has thus far given good results in forging, vitreous enameling and for reheating glassware.—*Proceedings Iron and Steel Electrical Engineers*, April, 1918.

Electrochemistry and Batteries

Purification of Sulphuric Acid for Storage Batteries.—Sulphuric acid for storage batteries should be chemically pure at a concentration of about 22 deg. Baumé, or even 34 deg. After having diluted it to the degree desired and having filtered it, it is essential to add 40 cu.cm. to 50 cu.cm. of a solution at 7 deg. Baumé of sulphur of barium for each 50 l. to 60 l. (52 qt. to 63 qt.) of acid. This mixture should be stirred and allowed to stand until no more sulphydric acid is given off. All the metallic impurities are thus precipitated and a very pure acid can be obtained by decantation.—*L'Industrie Electrique*, June 10, 1918.

Zorzi System for the Electrolytic Production of Hydrogen and Oxygen.—G. CARRARA.—The electrolytic cells of the new system devised by Zorzi are chiefly characterized by the absence of diaphragms and by the peculiar shape of the electrodes. Each of these is formed of sixteen iron bells open at the top, soldered to iron bars and equally spaced, each iron bell being covered by a glass one also open at the top. A larger glass bell covers the columns so as to lead the gas into a collector pipe. The gases developed at the surfaces of the iron bells are therefore immediately sent through the collector pipe, so that the diffusion of gases is reduced to a minimum. The cells are made of cement, sixteen cells forming a battery. The H and O collector pipes are connected to trunk collector pipes, which lead the gases to the gasometers. The electrolyte is a soda solution of density 1.17. The degree of purity of the gases obtained by the new system is very high—1.92 per cent of H in O and 0.34 per cent of O in H. Owing to their large content of electrolyte, the Zorzi cells allow of working at very different current densities without the purity of the gases being practically influenced. The new system is employed in the Neuport-Macchi works at Varese for oxyhydrogen and oxyacetylene soldering.—*Science Abstracts, Section B*, May 31, 1918 (abstracted from *Elettrotecnica*, March 5, 1918).

Telegraphy, Telephony and Signals

Telephone Lines in the United States.—G. VALENSI. A reprint of the extended report on American telephone practice made to l'Ecole Supérieure des Postes et Télégraphes on Oct. 12, 1917. The methods of construction, the use of aerial cables and the various means employed to locate defects are among the points discussed.—*Revue Générale de l'Electricité*, June 22, 1918.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

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PROMOTING CO-OPERATION IN INDUSTRIAL RESEARCH

Development of Existing Agencies Urged—Central Laboratories and Publication of Standards Based on Research Recommended

At the recent convention of the American Society for Testing Materials held in Atlantic City Alfred D. Flinn, secretary of the United Engineering Society, Engineering Foundation and Engineering Council, spoke of the necessity for further development and coördination of the existing agencies for industrial research. The National Research Council, the national engineering societies and their library, some government bureaus, many industrial establishments and educational institutions are conducting research of one kind or another, but they must be brought into a much closer relationship with one another.

Speaking more particularly of the part that the Engineering Foundation might play in this work of coördination of research, he mentioned: (1) the Engineering Societies' library, which needs larger additional funds for the creation of a great card catalog of scientific literature to enable many problems to be answered directly, without loss of time and money for research; other scientific libraries should be linked with this one; (2) great engineering laboratories should be established at two or three places in the country, to investigate engineering problems of public character; (3) the determining and publishing of engineering standards based on research work; (4) a research periodical wholly free from commercial basis, to convey the results of research to the profession and to the general public; (5) information as to the existing research centers and facilities, their equipment and facilities, and the problems under investigation. A preliminary list of such laboratories was appended to Mr. Flinn's paper.

INDUSTRIAL RESEARCH OF THE ONTARIO COMMISSION

Line Regulation, Insulator Troubles, Relay Protection, Inductive Interference and Best Types of Meters Among Subjects Considered

W. P. Dobson, assistant engineer of the Hydroelectric Commission of Ontario, says that the commission has recently conducted or is now conducting: "investigation of line regulation and the operating characteristics of the various machines on the system, insulator troubles, relay protection, abnormal conditions of voltage and current, inductive interference in telephone lines in the neighborhood of the high-tension lines, design tests on new types of apparatus, *e. g.*, insulators, meters, etc."

"A great variety of special tests have been made," so Mr. Dobson says, "among which may be mentioned the determination of the coefficient of expansion of various alloys to discover one with the same coefficient as insulator porcelain; heating of cables under heavy current; mechanical tests on insulators, bus supports, etc., rating tests on fuses, short-circuit tests on high-tension fuses, etc.

"The work of this laboratory also includes special investigations to determine the best make or type of meter for any particular purpose. These include the determination of the characteristics under varying conditions of load, frequency, temperature, power factor, wave form, etc., and also of the design characteristics."

Among special oscillograph tests may be mentioned an investigation of the voltage resonance due to the presence of electrolytic lightning arresters on 13,200-volt lines, a study of abnormal voltages appearing under certain conditions of transformer connections, flashovers of rotary converters, etc.

In addition to these special tests, which are of the nature of industrial research, the laboratory is carrying on regularly a large amount of routine testing in the following departments: (1) High-tension and general testing laboratory; (2) electrical standards and meter laboratory; (3) lamp-testing laboratory; (4) illuminating engineering laboratory; (5) structural materials laboratory; (6) photographic laboratory. This work includes acceptance tests of electrical goods purchased, examination of second-hand apparatus, insulating materials, oil, calibration of meters and of meter transformers, life tests on lamps, photometric tests, study of illumination, and investigation of cement and of concrete aggregates and mortars.

Research Work Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Technical Theory and Practice" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

HEADLIGHTS, AUTOMOBILE.

Careful tests of headlighting conditions were recently made under the auspices of the committee on automobile headlighting specifications of the Illuminating Engineering Society and the lighting division of the standards committee of the Society of Automotive Engineers. The tests were held on a piece of road between Pelham Parkway and the Morris Park station in New York. The purpose of the tests was to get the judgment of a large number of observers on two points—first, the illumination required to render visible a man in dark clothing at distances of 150 ft. (45.7 m.) and 250 ft. (76.1 m.) from the observer; secondly, to determine how much each observer would tolerate in the way of glare in his eyes from two headlights placed 100 ft. (30.5 m.) from his own lamps, and to one side of them, with his own lamps adjusted at the intensity which he required for observing the man on the road 250 ft. (76.1 m.) away.—*C. H. Sharp, New York City.*

TELEPHONE, ARTIFICIAL CABLE.

I was able to talk through 1000 miles of artificial cable in the following manner: I used a regulation telephone artificial cable with a distributed capacity of 80 microfarads and 8000 ohms resistance. Additional resistance, up to 10,000 ohms, and additional capacity up to 150 microfarads, could be connected into the circuit at will. An ordinary detective circuit of the Armstrong regenerative type was used with an auxiliary circuit crossed with a condenser of 0.02 mfd. and with the cable shunted across the condenser. When one side of the bridge was grounded with a distributed capacity the voice was lost entirely; but I found that by preventing the oscillations from entering the cable, except as impacts, I was able to transmit the human speech in sections with certain sections left out. These were so small in comparison with the aggregate that commercial conversation was entirely feasible.—*S. N. Baruch, San Francisco, Cal.*

Readers' Views and Comments

Steps Toward Coal Saving

To the Editor of ELECTRICAL WORLD:

Sir: Your editorial article in the July 20 issue of the ELECTRICAL WORLD in regard to "Coal Saving" is a timely reminder of the fact that not only is a large amount of our fuel shortage due to our inefficient use of that fuel, but also that pure waste of it in many small ways is a considerable factor in that shortage. In connection with our quarterly conference held on July 19 I had to prepare a report on the question of fuel and I append part of it:

"In my visits around Texas, among members of my association and those who are not members and among the largest as well as the small and medium-size utilities, I have seen from 25 cents to 50 cents per ton of coal or lignite wasted in its man-handling from car to ash pit. I have seen an additional 'two bits' go up the smokestack in free carbon, carbonic monoxide and lost available heat. I have seen this repeated in the quality and temperature of feed water, I have seen it re-repeated in uninsulated piping and apparatus, and I have seen it go still further in its misuse in the prime movers and the exhaust. I have seen in Texas a waste in fuel efficiency of from 50 per cent to 65 per cent, thousands and hundreds of thousands of dollars of needless waste in the aggregate. Few of us can hope to reach 20 per cent efficiency, but we need not drop to 10 per cent and even as low as 5 per cent—because every single percentage which we needlessly waste by inefficiency means cents and dimes and dollars of profit out of our pockets, means unnecessary haulage when cars are so vitally needed and means a waste of labor when labor is getting as 'scarce as hens' teeth.' The utilities of Texas could, with but little financial cost to themselves, save millions of cubic feet of gas, thousands of barrels of fuel oil and thousands of tons of coal and lignite by strict attention to the elimination of waste in the use of the above fuels."

I would add that the question of "firing" is generally the one least slighted. Nearly every one using fuel has had the matter of its "combustion" so strongly placed before him that in nearly every case some attempt is made to obtain the actual combustion of the fuel on the grate bars in a more or less efficient manner. My researches in this matter for a number of years have proved to me that a very large loss in fuel efficiency occurs before the fireman's shovel touches it and after its combustion. I have found most wasteful methods of handling right up to the furnace doors—and every ounce wasted in this manner when multiplied by the thousands of such cases not only means many unnecessary cars of fuel hauled but it also means many dollars added to the "billing cost" of that fuel which is finally received and used. In addition to this are the many obstacles placed in the way of the heat units entering the boiler, the soot and scale on the outside of the shell or tubes, the scale on the inside of them and the preheater, cracks and apertures in the setting, wrong arrangement of fire wall and baffles, and wrong location and use of dampers. These, however, are only the beginning. Once the steam is loosed from the boiler there is often a steady loss in its temperature accompanied by an increase in its water content up to the time that it enters the prime movers. Direct steam leaks, steam carriers exposed to radiation, unnecessary bends and valves which retard its flow, all tend to loss of either the steam or its necessary heat and pressure. Once in the prime mover, lack of proper lubrication, lost motion or leakage past valves may again result in loss of efficiency. And when the steam has completed its more or less efficient work in the prime mover and its auxiliaries it is often the case that the exhaust steam has both heat and pressure which are thrown into the atmosphere as if they were of no further value—a large percentage of the B.t.u.'s available for further useful work being "put into the dump."

If these losses were confined to the hundreds of thousands of small fuel users, even then the total waste of fuel would be appalling, but my observation has shown that they are not so confined. Many of the larger plants are ignorantly or idly wasting from 2 per cent to as much as 5 per cent or 6 per cent of their fuel either directly or indirectly. The extremely large plants —public utility and otherwise—that use fuel are generally doing so with an efficiency that approaches from 15 per cent to even as much as 20 per cent, but their saving—notwithstanding their size—is a small amount compared with the loss of the many of smaller size whose efficiency in the use of fuel as a whole runs from as low as 5 per cent to an average maximum of not over 12 per cent to 13 per cent.

Close observation and experience in this matter have led me to the full belief that the crying need with reference to fuel at this moment is the lessening or stoppage of millions of small "fuel leaks" and inefficiencies going on in nine-tenths of the places where fuel is now being used for the various kinds of steam production, and I am also of the opinion that a dominant percentage of the savings which would result from a lessening or stoppage of these inefficiencies may be made with so small an amount of total investment for the purpose that 90 per cent of these fuel wasters would make more net profit out of such investment than they are now doing on a similar amount in their regular business. I believe that it is the duty of every publication such as the ELECTRICAL WORLD to "keep it before the people" in every issue that the crying sin of the moment is the needless waste of fuel, that one of the highest types of civil-life patriotism is in its saving, and that the largest portion of its saving may be made, not by a lesser needful use of it, but by a more careful and efficient method of use from mine to exhaust head.

Dallas, Tex. H. S. COOPER.

Self-Inductance of Coils

To the Editor of ELECTRICAL WORLD:

Sir: In a letter published on page 1330 of the issue for June 22, H. E. Weightman states that the Brooks-Turner formula for self-inductance of coils is sufficiently accurate for practical manufacturing conditions, and that the longer formulas published in my article in the ELECTRICAL WORLD of Feb. 9 on the "Self-Inductance of Long Reactance Coils" are not necessary. Presumably the same criticism would be applied by him to the similar formulas given in my article on "The Self-Inductance of Short Reactance Coils," in the issue of May 25.

For several years, since the Brooks-Turner formula was published, I have used it to calculate roughly the self-inductance of coils, and I consider it a remarkable and an admirable example of the approximate expression in concise form of a complicated relation. However, instead of its possible error being 2 or 3 per cent, as inferred by Mr. Weightman, it is at least 5 per cent for practical commercial coils.

For example, the coil described in Problem II of my article on long coils mentioned above has proportions which are usual for current-limiting reactors. The self-inductance of this coil, as calculated in the article, is 0.07700 henry, but the self-inductance according to the Brooks-Turner formula is 0.0804, thus indicating an error in the latter formula for this case of 4½ per cent.

A formula which can produce such a large error is usually undesirable for use in manufacturing reactance coils to specifications, where a certain value of reactance is required.

The dimensions of large current-limiting reactors are determined by the molded spacers, and not by the size of the conductors. Even with smaller coils, the dimensions are largely determined by the mold size and are only partly influenced by the variations in conductor size cited by Mr. Weightman.

The accuracy with which the inductances of several coils made according to the same design agree with each other and with a carefully calculated value indicates that the practice adopted and advocated by Mr. Weightman of taking off some turns after testing (which is a poor engineering practice if it can possibly be avoided) is due possibly not so much to variations in the material as to the fact that Mr. Weightman used a faulty formula. A little more calculation would save considerable labor and cost.

Hamilton, Canada. H. B. DWIGHT.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

HYDROELECTRIC DEVELOPMENT FAVORED BY DIRECTOR McADOO

He Suggests that Country's Vast Water-Power Resources Be Developed for Railroad Electrification and to Relieve Fuel Shortage

Director General of Railroads McAdoo, on his return to Washington on Monday, after a two months' tour of the West, expressed the opinion that the great unused water-power facilities of the country ought to be developed to supply electricity for electrification of the railroads. This program might be recommended to Congress, Mr. McAdoo intimated, if government control of the railroads continues for any considerable period; but that is too problematical for any serious discussion.

Director General McAdoo holds the opinion that there is sufficient unused water power in the country to operate a large part of our railroad system if it is coupled with the developed water properties, now operated largely by public service corporations.

Electrification of the roads, Mr. McAdoo pointed out, would mean the elimination of the major burden now imposed on the railroads, *i.e.*, the tremendous coal haul. In addition, it would release to other more essential uses the great labor army now engaged in mining and handling this fuel. Finally, it would conserve the fuel resources of the country for use in sections where water-developed electricity is unavailable.

ELECTRIC WELDING SUPPLANTS RIVETING IN SHIP WORK

England Tries Out First Rivetless Vessel and Great Savings Are Predicted—Welded Ships to Be Built by U. S. Shipping Board

The first steel vessel built without rivets has just been tried out somewhere on the south coast of England. With a full cargo and in rough weather she answered satisfactorily the most severe tests imposed upon her.

The vessel is 125 ft. (38.1 m.) between perpendiculars, 16-ft. (4.9-m.) beam, and has a displacement of 275 tons. More than 240 man-hours were saved in construction and an economy of more than 1000 lb. (45.3 kg.) of metal was effected by the absence of rivets.

Instead of the plates of this vessel being riveted and calked, they are joined together by electric welding. The shell, up to and including the bottom seam of the bilge plate, is continuously welded inside and out. The cross-seams are similarly treated. The outside is continuously welded and the inside "tack-welded," that is to say, a short section is welded and then another section of about twice as much is skipped. The frames, floors deck brackets and non-water-tight bulkheads are tack-welded, and the water-tight bulkheads continuously welded. In the case of the deck plates butt-welding has been adopted, the plates being arranged end to end, without any overlap. It is considered that the mode of construction that is being followed allows a good margin of safety.

The cost of electrodes, owing mainly to the present limited use, was considerable, but it is estimated that in the future demand competition will reduce the price 60 per cent. It is possible to build a vessel, six experimental ships show, at a saving of from 25 to 40 per cent in time and of about 10 per cent in material. The United States Shipping Board, it is said, has been in close touch with this experimental work, with the result that arrangements are in hand for the manufacture of sections of 10,000-ton standard ships, in the production of which riveters will become welders. Unlike the ship just tested, these vessels will not be entirely rivetless, but they will have, it is computed, only about 2½ per cent of the number of rivets originally intended.

PRIORITIES HEARING HELD ON HEATING APPLIANCES

Judge Parker Asks Committee to Go Through List and Cut Out Every Appliance Not Government Essential

The war service committee of the electric heating appliance manufacturers had a conference in Washington on Friday, Aug. 9, with the priorities committee of the War Industries Board. The committee consists of the following: W. M. Stearns, chairman, General Electric Company; F. D. Goode, Cutler-Hammer Manufacturing Company; George A. Hughes, Edison Electric Appliance Company, and Robert Kuhn, American Electrical Heater Company.

The object of the meeting was to supply information and evidence to the priorities committee of the conservation of raw material, fuel and labor in the manufacture, use and sale of electric heating appliances. There are altogether 190 manufacturers of electric heating appliances in the United States. An indication of the importance of the industry is shown by the volume of business for the year 1917—$13,000,000—of which about $1,500,000, or approximately 12 per cent, was direct and indirect government work.

The electric heating appliance work given a Class A listing by the priorities committee consists of ranges, ovens and other cooking equipment for battleships, destroyers and submarines, cantonments, naval training stations, field kitchens, etc.; air and water heaters for ships, battleships, destroyers, submarines, hospitals, explosive plants, etc.; electrically heated clothing for aviators, electric heaters for machine guns, soldering

irons and glue pots for aircraft production, munition and explosive plants, etc.

The committee submitted considerable information showing how electric heating appliances conserved labor and land transportation, together with tabulated data as to the volume and distribution of business, the location of manufacturing plants, number of employees, percentage of women employees, and amounts of raw material used in the past, on hand at present and required for the future. The committee also offered a pledge on the part of the electric heating manufacturers to coöperate fully with the government in the conservation of materials, fuel, labor, transportation, etc., and the committee further offered to act on behalf of the War Industries Board in policing the industry, so as to effect the greatest possible conservation of material, keeping down the output to the least possible point during the period of shortage of materials that is consistent with meeting a strictly war-time demand for appliances essential to the civilian population.

PRIORITIES COMMISSIONER'S REQUEST

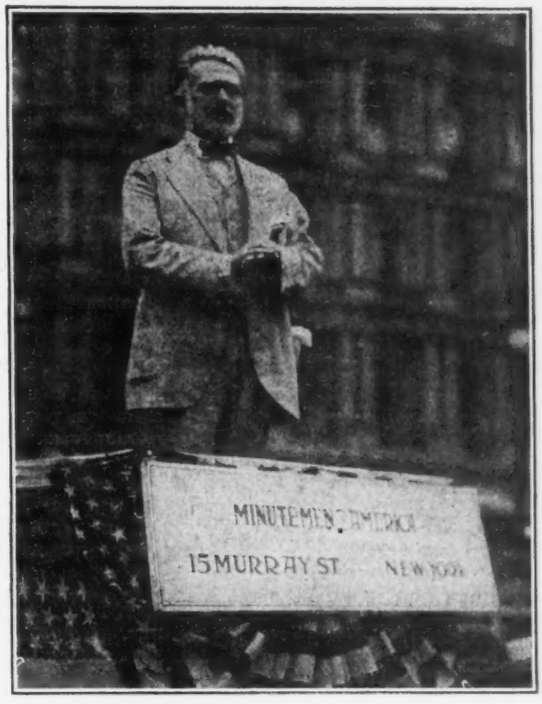
Judge Edwin B. Parker, Priorities Commissioner, expressed his interest in and approval of the growth and development of the electric heating business and his desire, under normal conditions, to see the expansion of such business. He pointed out, however, that the country was facing a serious shortage of essential materials, such as iron and steel, copper, brass, aluminum, etc., and that every pound and ounce possible must be saved. He said:

> First, through your committee, or through some other agency, steps should be taken to cut out absolutely the sale of new electrical heating equipment in those sections where electric power is short.
>
> Second, your salesmen, your distributers or agents should be instructed to reverse their ordinary selling practices and educate the people to use the appliances that they have just as long as it is possible for them to use them and to repair them as long as they can repair them, without replacing them with new equipment.
>
> Third, there should be no effort to replace, under any circumstances, a wood-burning range with an electric range, and there should be no effort to replace a coal-burning range that will last until after the war, where the coal is available, but we should undertake to make the existing apparatus and appliances last until after the war where it is possible to do so, rather than to replace them with new apparatus or appliances in any form.

Judge Parker asked the committee to go through the electric heating industry and use freely the knife and "cut right down to the quick" every appliance produced that is not essential and then return with a program to submit which will show the extent to which these different products can be cut out or curtailed to reduce the consumption of raw material for the rest of this year, with a tentative program for the following year.

This, therefore, the committee believes, means coöperative action by the War Industries Board and the war service committee of the electric heating manufacturers and the manufacturers themselves which will put the industry on a definite war basis and cut out all the non-essential elements of production, and, while it will reduce the volume of business and earnings, will insure the production of the essential appliances in public demand.

Public Utility Men in War Saving Stamp Drive



Henry L. Doherty addressing crowd in City Hall Park, New York, on the necessity of backing the government with funds for carrying on the war.

COMPETING PUBLIC UTILITIES URGED TO INTERCONNECT

Merchants' Heat & Light Company and Indianapolis Light & Heat Company Urged to Pool Their Systems During the War

In handing down its decision affecting the rates of the Merchants' Heat & Light Company and tne Indianapolis Light & Heat Company, the Public Service Commission, after increasing certain surcharges, pointed cut that some additional relief might be obtained by a correction of existing conditions by the companies themselves. The recommendations made by the commission to the companies operating in Indianapolis are as follows:

> In the electric field occupied by petitioners there was no great objection in normal times to duplications that assume different importance in these days, when operating costs make it necessary for these utilities to seek relief, and when they seek all the relief at the expense of patrons served. In this war period there must be taken into consideration by the commission the existence of two complete institutions and inevitable duplication of at least certain heavy overhead expenses and also losses, or waste, arising from failure to coördinate operation of five different plants such as would be the case under an unified war-period operation.
>
> There has existed, at least within a very recent period, a competitive rivalry or war of extermination that at times has known no bounds and that has been wasteful in many ways. Petitioners urge that, under an understanding recently reached, competitive solicitations and practices are to be held in abeyance, but an analysis of the estimates for the year ending June 30, 1919, reveals that the items of accounting under which such competition—from advertising to solicitation and "throwing out each other's meters"—are

carried show increases instead of decreases, although the increases are not large. The conditions are such, however, that there is a constant waste of money and labor that is not compatible with the period of economics in which the country is now living.

The really sinister side of these conditions now is coal waste. Consulting engineers of repute and managers of other utilities have placed as high as 75,000 tons a year the unnecessary use of coal arising from no connection between or coördination in the operation of the five plants of petitioners. While petitioners deny that larger consumption of coal could be saved, still it is admitted that 10,000 tons of coal could be saved if there were physical connections and war-period poolings and readjustments, such as are being carried on at many other points. Even such a saving as is admitted would amount to the needless movement and use of 200 to 225 carloads of coal, or enough to meet the demands of a town of 2000 or 2500 people.

The Legislature, in enacting the Shively-Spencer Utility Commission law in normal times, wisely did not place in the hands of such commission coercive powers of consolidation or pooling, but in meeting the unusual conditions now presented such waste and other conditions press for consideration. The commission is led to believe, by advice of consulting experts and by consulting conditions elsewhere, that some increases now called for as measures of relief would not be necessary were the services unified either by one ownership or effective pooling for war-period operation.

The commission is of the opinion that owners of these public utilities should not be permitted under these conditions, over which only they have control, to shift all the burden of such waste and duplication. Those financially interested in these institutions may increase their earnings by bringing them into unity, either by merging or by practical pooling of interests for war-period operation. Such a unification is certainly urged as a measure of economy directly in line with the general policies of economy that are now being applied nation-wide, and if not done voluntarily, the federal government will be justified in taking steps forcibly to cause readjustments for the saving of coal, labor and materials.

MANY PUBLIC UTILITY COMPANIES GET RELIEF

Increase in Rates Generally Allowed by Public Service Commissions from Coast to Coast as a War Measure

An interesting summary has been prepared by the National Public Utilities Committee showing the action of state commissions affecting rates for the period extending from May 18 to July 13, 1918. In this period of less than two months many increases were granted by state commissions to every class of utility from Massachusetts to California.

In the sale of electricity commissions allowed straight increases to thirty-two different companies, and in eight cases temporary increases or surcharges were granted. In only one case was an increase in rates denied. The companies affected were in Illinois, Indiana, Missouri, Montana, New Jersey, North Carolina, Oklahoma, Utah, Wisconsin and Wyoming.

In summing up conditions in the first six and a half months of 1918, the National Public Utilities Committee says:

Some relief has been secured. Between 600 and 700 rate increases have already been reported since Jan. 1, 1918, and relief in other forms has been noted in a number of cases. In a few states the commissions have issued sliding-scale orders, so that the rates of the companies affected will automatically follow the fluctuations in operating costs above a fixed normal point. In some states the commissions have adopted a policy of allowing surcharges on bills to cover the increased costs of operation due to war conditions. In a number of instances complaints calling for a decrease in rates have been dismissed.

A very important development in several jurisdictions is the adoption by the commissions of a war emergency procedure, eliminating appraisals of property and other time-consuming investigations regarded as necessary in normal times. Broadly speaking, a majority of the commissions having full rate-fixing powers have shown a disposition to grant relief; several have fallen short of reasonable expectations, and a few have apparently failed to recognize the recommendations of the President.

Public service, corporation or railroad commissions now exist in every state except Delaware, but many of these commissions have no jurisdiction over public utility rates, and several have had their rate jurisdiction curtailed by decisions of the courts upholding rates fixed by franchise or contract. Reports from the states where commissions do not have full rate jurisdiction and where companies are compelled to secure relief from municipal authorities indicate very critical conditions. In these localities the efforts of the companies to secure revenue sufficient to meet the increased cost of labor and materials brought on by war conditions have generally failed, and further efforts are apparently foredoomed to failure. This situation demands federal intervention and the establishment of some machinery by the federal government that will save the communities affected from untimely disaster and spare the nation's financial structure the shock of the wholesale bankruptcy of the companies involved.

BOSTON EDISON COMPANY RATE CASE MUST PROCEED

Commission Decides that Petition for Reduction Must Be Heard, Despite War Conditions and Uncertain Outcome

The commercial rate case of the Edison Electric Illuminating Company of Boston must be heard despite war conditions, according to a finding of the Massachusetts Gas and Electric Light Commission, dated Aug. 9. The petitions in question (Macfarland et al. vs. Edison Electric Illuminating Company) were filed in 1916, but by mutual consent have been deferred pending the conclusion of the recent celebrated street-lighting rate case of the same company. At a recent hearing the company moved to postpone further consideration of the petitions during the war against Germany. In support of its motion the company urged the improbability of any order for a reduction in price under the present abnormal conditions, the lack of the requisite time and money for a proper presentation of its side of the case, and the futility of any investigation of the facts upon which rates reasonably may be based in view of the instability of the factors entering into the problem. In opposing the motion the petitions urge that the postponement asked, if granted, would amount substantially to a denial of a hearing to the petitioners.

The commission holds that the law requires it to hear complaints concerning price, the board's discretion being with respect to their disposition when heard. The Legislature doubtless intended to leave the conduct of such cases to the sound judgment of the board, but not to authorize it either directly or indirectly to refuse the complainants a hearing. In its ruling the board says:

It is true that the motion is for postponement only, but the duration of such postponement is indefinite and may be

for a considerable period. Since the war began there have been many increases in rates by companies under the board's supervision. Some require affirmative action by the board, but many do not, and the only opportunity for customers to have such increases reviewed has been by complaint under this same section [of the statute]. The board has believed that all such cases, whether the customer or the company were the moving party, should be promptly heard and has acted upon this belief.

It may be claimed that the complaints under consideration differ because filed before the war began, with a view to the conditions then prevailing, and that the company has not meantime raised its maximum net price. It has, however, increased its other prices by the introduction of a so-called "coal clause," and this feature has been brought in issue by an amendment to the pending complaints. Unless the board is to postpone for the duration of the war the consideration of all proceedings under the statute where maximum prices have not been increased, it cannot properly allow this motion, and in the opinion of the board this policy would be inexpedient and unwise, even assuming that it has au'hority to do so.

In stating this conclusion, the board recognizes the unusual burdens and anxieties which this period of stress has brought to this and all the companies under its supervision and the primary importance to the communities served of continuous and adequate service. It is not unmindful of the difficulties of reaching any reliable results as to fair and reasonable rates at a time when the costs of operation and financing all companies providing public service are exceptional and unprecedented, nor of the embarrassment to all concerned, and even futility under the circumstances, of protracted rate hearings. The latter consideration, however, relates to the conduct of such cases and is plainly within the direction of the board as they proceed.

In deciding such cases as have arisen since the war began, the board has also repeatedly expressed the view that in abnormal times it is expedient not to attempt to reach any final judgment, but rather to make such temporary readjustments in price as may be necessary to preserve the efficiency and financial integrity of the companies and to protect the consumers from any exploitation under the guise of war conditions and to defer any final settlement of rate questions to the return of stable conditions and normal costs. But this is a consideration which has to do with the conduct of the cases and their disposition after they are heard, and not with the issue raised by this motion. The motion to postpone is accordingly disallowed.

CITY OF SEATTLE WINS IN SKAGIT BOND FIGHT

Capital Issues Committee Authorizes Issuance of $5,500,000 for Construction of Hydroelectric Station to Serve War Industries

The city of Seattle has been authorized by the Capital Issues Committee at Washington, D. C., to sell $5,500,000 in bonds for the construction of a hydroelectric plant on the Skagit River to serve war industries.

This clears the way for immediate action by the city toward the development of a 35,000-kw. unit of the power project, as no vote of the people is necessary for authorization of the bonds.

The project had been reported adversely by the capital issues sub-committee of the San Francisco Federal Reserve Bank, but was brought before the national committee at Washington, D. C.

Three sites for development of hydroelectric power are available on the Skagit River, and the city has priority rights on all of them. The present bond issue, now authorized, is designed to cover the first site, or the Gorge Creek development, which is to furnish 35,000 kw.

COAL SITUATION DISCUSSED BY FUEL ADMINISTRATION

Indiana Central-Station Men Are Given Advance Information on Scope of New Order and Have Opportunity to Ask Questions on Local Problems

"War conservation of power and light" was the topic of an address delivered by Howell Van Blarcom, assistant to Charles E. Stuart of Washington, D. C., chief of the power and light division, United States Fuel Conservation, before the Indiana Electric Light Association on Aug. 30. Mr. Van Blarcom pointed out that, while the first estimate showed that there would be in the coming year a shortage of 100,000,000 tons of coal, subsequent estimates showed the shortage would be around 35,000,000 tons. He even intimated that the shortage might possibly not be quite so much, but he stated emphatically that the conservation program must be carried on just as if there had been no change in the original estimate and as if the country still stood to be 100,000,000 tons short for the year. As a reason for this policy he cited the fact that there is a steel shortage which can probably be overcome if there is an adequate supply of coal. He also reminded the delegates that the inconvenience which coal users are being subjected to in this country is really only a minor consideration compared with the dreadful shortage of fuel which is facing our allies.

Mr. Van Blarcom predicted that there will be curtailment of industry in New England. He said there is now building about 1,000,000 kw. of turbine capacity in this country, but even if all of this could be shipped to its destination and installed in the New England states, it could not turn out a single kilowatt-hour, owing to the physical impossibility of getting coal to run additional plants. He predicted that three-fourths of this turbine capacity will never reach the destination for which it is now intended but will be diverted into other parts of the country where it will be possible to place it and send coal to it. He also brought out in this connection that the War Industries Board does not intend to place any more orders for government equipment unless an adequate supply of power can be secured in the community seeking the order.

Concerning the necessity of saving coal in power plants, Mr. Van Blarcom said that careful and resourceful firing of furnaces must have immediate attention. He also said that the uneconomical isolated plants would have to be shut down, perhaps only during the summer months or perhaps for the duration of the war. Interconnection between public utility plants is desired by the Fuel Administration. It is the desire, of course, to make it easy for all of these transfers of loads to be effected, but steps must be taken to save the coal very soon.

The speaker stated definitely that within a short time there would be issued an order that would take up many phases of coal saving interesting the central-station men. It will deal with lamp policies, the changing of which is expected to effect a saving of from 1,000,000 to 2,000,000 tons of coal. The order contemplates reducing the sizes but not the number of lamps. Carbon and "gem" lamps are to be gradually eliminated. Free renewal is to be discouraged, and all policies calculated to induce the customer to buy a larger lamp than is absolutely

necessary for his needs must go by the board. Even in replacing carbon lamps with tungston lamps central stations will be asked to make the change in such a manner as to give the customer the same amount of light he has been having, instead of making it on a wattage basis.

The order will affect other businesses as well as public utilities. Among these are the ice companies, some of which are operated in conjunction with central stations. As soon as weather conditions will permit it, ice companies in every locality will be required to pool their manufacturing facilities, and instead of running several plants lightly loaded in an inefficient manner, one plant or two plants will be run at full capacity and the demands of all ice companies will be supplied from these plants. In industrial establishments factory conservation committees consisting of employees will be formed. The committees will go into the subject in detail.

It is also part of this plan to connect every hydroelectric plant with some steam station so that all of the available water power can be utilized to save coal.

The discussion that followed Mr. Van Blarcom's address consisted mainly of questions. The first of these pertained to the status of the domestic motor-driven refrigerators. The inquirer asked whether the Fuel Administration would countenance the use of motor-driven refrigerators, rather than ice, to which Mr. Van Blarcom replied that it was entirely a matter of coal saving, and if the domestic motor-driven refrigerator could be operated with the consumption of less coal than would be required to produce the ice, it should by all means be employed. In reply to a question about means of getting manufacturers now already on central-station service to arrange their operations so as to take some energy in the valley of the central-station load curve to save coal, Mr. Van Blarcom intimated that the question should be taken up before public service commissions.

In explaining the lamp situation the speaker stated that the lamp manufacturers have been brought together and that those making carbon lamps, by going over their orders, determined what output of carbon lamps was absolutely necessary for such uses as the navy drop-cord extensions and other places where lamps were subjected to excessive jarring. To fill the needs of such places will probably take only 25 per cent of the former output of carbon lamps. The production of this output will be turned over to the factory which makes only carbon lamps.

On the question of continuing the daylight-saving plan throughout the year, Mr. Van Blarcom suggested that the officials at Washington would be very glad to know what is the consensus of opinion of the Indiana Electric Light Association. He said the question of whether this should be continued throughout the year or should be used only during the summer months was now up for discussion.

In closing, the speaker intimated that isolated plants using an excessive amount of coal per kilowatt-hour should be reported to the local fuel administrator. In case this official is unable to prevail upon them to take service from the central station and discontinue operating inefficient plants, it is the duty of every one cognizant of the situation to report it to the Fuel Administration at Washington, D. C.

GOVERNMENT NEEDS RADIO AND TELEPHONE INSTRUCTORS

Men Having Practical Teaching Ability and Who Are Not Subject to the Draft Are Being Sought for This Work.

It is anticipated that twenty-four institutions of this country will probably be engaged in the training of drafted men in special classes of radio and telephone work. Instructors are needed for this work. The training which these men should receive in radio is of special type. The instruction can be given by the combined engineering and physics faculties in no one institution. The training to be given the telephone electricians calls more especially for electrical engineering instructors.

The ELECTRICAL WORLD has been asked to assist the committee on education and special training of the War Department to help obtain instructors for the different institutions. The committee believes that there are many available men who will never be in Class 1 of the draft, even with the draft age extended, and who may well qualify as instructors. It is its idea to depend upon men of practical teaching ability not subject to the draft. Nor is it necessary that these men have a knowledge in detail of radio work, because it is well known that there are not a large number of men so trained. Candidates should address the committee at the Old Land Office Building, Washington, D. C., if they are available for this type of work in institutions.

INDUSTRIES ASKED TO CO-OPERATE TO SAVE FUEL

Massachusetts Manufacturers Are Earnestly Striving to Save a Million Tons of Coal This Year and Avoid Shutdowns

"Massachusetts manufacturers can save this year more than 1,000,000 tons of soft coal if they all cooperate in the war-time fuel conservation move," declared James J. Storrow, federal Fuel Administrator for New England, in a recent interview. Three thousand industrial plants in Massachusetts are in danger of a curtailment of their supply of coal next winter unless increased coöperation is rendered in the campaign against fuel waste. Seventeen hundred of these plants are already enlisted in the work of coal saving along the lines planned by the engineering committee which is assisting the administration. The plan includes the establishment of factory committees to cut down needless losses in the use of lighting, power and heating service.

In western Massachusetts this work has been taken up with great enthusiasm, and 71 per cent of the industrial plants west of the Connecticut River are cooperating with Mr. Storrow's organization. The city of North Adams, with every one of its twenty-two industrial plants pledged to conserve steam coal, heads the list of Massachusetts municipalities, and Boston is tenth, with 73.8 per cent of its manufacturing establishments engaged in active coöperation. The state has been divided into five districts in which fuel-saving work is being carried on. In the southeastern district, where the poorest showing has so far been made, only about 45 per cent of the plants have enrolled in the campaign.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Increase in Street-Lighting Rate.—The Pennsylvania Public Service Commission in allowing the Montgomery & Muncy Electric Light, Heat & Power Company to increase its street-lighting rate in Muncy Borough held that where the evidence shows a large increase in cost of production an increase in rate will be approved—especially when it is shown that a similar rate for like service is already in effect in other communities.

Company Practice.—The Pennsylvania Public Service Commission, in a decision affecting the Coalport Light, Heat & Power Company, holds that an order by the commission requiring twenty-four-hour service throughout its territory is substantially complied with even though the service company omits daylight service on Sunday where there appears a necessity for it only in emergency by an occasional patron. This is especially so when the service company is small and lacking in reserve power and employs this idle time in keeping its plant in serviceable condition. A rule of the service company by which it proposes to relieve itself of liability for damage resulting from use of power has no place among the filed rules and will be eliminated. Where a deposit of $5 is required by the service company rules, which, by the evidence, appears to be excessive, the deposit will be reduced.

Consolidation in Massachusetts.—In approving consolidation of the Stockbridge Lighting Company, Lenox Electric Company and Great Barrington Electric Company, the Massachusetts Board of Gas and Electric Light Commissioners says in part: "The lines of the Lenox and Great Barrington companies are in towns contiguous to Stockbridge. Neither the Lenox nor the Stockbridge company has ever generated the electricity which it distributes. The Lenox company has purchased energy from George Westinghouse or his estate, which the latter had in turn purchased from the Stockbridge company. The last-named company has purchased its electricity in part from the Monument Mills and in part from the Great Barrington company. The Monument Mills and the Great Barrington company have hydroelectric developments on the Housatonic River which produce the electricity in question. It is manifest that the three properties, while only recently brought under a common control, have been developed as integral parts of one system. The proposition to make their physical union complete by their legal merger should prove of distinct advantage to the public. It will do away with most of the present complex contractual relationships for the supply of electricity and should insure more economical financing and operation of the system. By reason of the proposed consolidation the facilities for furnishing and distributing electricity will not be diminished, and no increase will be effected either in the aggregate capital stock or in the aggregate debt of the three corporations."

Kansas Commission Rules on Service Extension.—In a recent case of the Kansas Gas & Electric Company, Wichita, before the Kansas Public Utilities Commission a ruling was established on customers' war-time extensions. The order is to be effective until twelve months after the signing of a treaty of peace between the United States and Germany and Austria. The commission found in part: "In making extensions to supply service to intending consumers the Kansas Gas & Electric Company has heretofore incurred certain indebtedness now due and accruing due; that, owing to present financial conditions due to the existence of the war, the company is unable properly to finance its business or to raise money to pay its indebtedness or make all necessary extensions for the service of consumers; that, if extensions costing in excess of $20 each are requested by intending domestic consumers of electric energy, or extensions costing any sum are requested by intending power customers, it is necessary that the cost of all power extensions and the cost of extensions to domestic consumers in excess of $20 for each extension be advanced and loaned to the company by the consumer desiring service by means of any such proposed extension, such advance or loan to be repaid by the company with interest thereon at the rate of 6 per cent per annum. . . . In case an advance or loan is made by the consumer to the company for the purpose of erecting or installing an extension or aiding therein, the company should each month credit such consumer's account for electric energy or power furnished to consumer over the line constructed by means of such advance with an amount equal to 33⅓ per cent of consumer's bill for electric energy or power furnished by the company during the preceding month until such loan or advance with interest thereon is paid in full; provided, however, that no credit shall be allowed during any period in which consumer is in default in payment of bills. . . . In estimating the cost of any extension to be made for the service of a consumer there should be allowed for engineering, supervision and use of tools and equipment not exceeding 5 per cent of the cost. Any sum or sums bona fide invested by the company in the erection and installation of service extensions for consumers in accordance with the foregoing findings should be charged by the company as, and held to be, a part of its capital investment."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Northwest Electric Light and Power Association.—The next annual convention of the Northwest Electric Light and Power Association will be held in Portland, Ore., on Friday, Sept. 13. George L. Myers is secretary of this association.

A. I. E. E., Indianapolis-Lafayette Section.—E. B. Schley was elected chairman and William H. Beck was elected secretary at a recent meeting of the Indianapolis-Lafayette Section of the American Institute of Electrical Engineers.

American Gear Manufacturers' Association.—The semi-annual meeting of the American Gear Manufacturers' Association will be held at the Onondaga Hotel, Syracuse, N. Y. on Sept. 19, 20 and 21. Announcement of the program will be given at a later date.

A. I. E. E., Fort Wayne Section.—On July 11, at the Fort Wayne Works of the General Electric Company, Chairman J. J. Kline gave a report on the Institute's annual convention at Atlantic City before the Fort Wayne Section of the American Institute of Electrical Engineers.

N. E. L. A. New England Section.—Notice has been issued by Miss A. O. Bursiel, secretary, that the tenth annual meeting of the New England Section of the National Electric Light Association will be held at the Hotel Kimball, Springfield, Mass., on Sept. 27 and 28. There will be three sessions devoted entirely to subjects connected with the share of the central stations in the war program. All entertainment features will be omitted.

California Association of Electrical Contractors and Dealers.—The monthly meeting of the California Association of Electrical Contractors and Dealers held at Oakland, Cal., on July 30, with over 100 in attendance, was largely devoted to the work of the co-operative campaign. L. H. Newbert, chairman of the campaign committee, outlined objects and progress of the campaign; R. M. Alvord, in reporting on publicity committee work, showed how individual members could help and called for their aid; M. L. Scobey explained how the dealer can aid in and profit by the educational work; H. C. Reid told why the contractors should support the co-operative movement; D. E. Harris discussed the effect of priority policies on the electrical industry and how unessential work of salesmen could be reduced. The topic of the final speaker, Albert H. Elliot, was "Loyalty to the Association."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Many Byllesby Men in Service.—A bound booklet recently issued by the publicity department of H. M. Byllesby & Company shows that 695 employees of H. M. Byllesby & Company and affiliated companies are now in national service. This is more than 14 per cent of the total employees of the company. This booklet not only gives the names of the men, but gives their rank and their army or navy addresses.

War Courses at Lehigh.—President H. S. Drinker, Prof. C. L. Thornburg and Prof. F. P. McKibben of the faculty of Lehigh University returned recently from Washington, D. C., where they had a conference with the committee on education and special training of the War Department in regard to the military training adopted by Lehigh University. As a war measure Lehigh University has recast its four-year courses so that by the elimination of a part of the usual vacations and by intensive work students are now enabled to gain the university's degrees in engineering and arts and science in three years. Lehigh will inaugurate in September a three-year course in ship construction and marine transportation.

Developed Power in State of Washington.—The Bureau of Statistics and Immigration of the State of Washington has issued a book on manufacturing opportunities in that state which speaks of water-power conditions as follows. "While the electrical industry as a whole is increasing at a tremendous rate in various parts of the country, the Pacific Coast has experienced a greater increase in water-power development within the last few years than any other section. Yet of all the vast potential power, the total amount developed in Washington is now only slightly over 300,000 hp. Conditions are rapidly changing, however. Since many new industries have sprung up during the past twelve months and many more are now being established, it has become necessary to increase also the amount of power available."

New Army Training Corps.—The War Department has obtained the services of Dr. R. C. McLaurin, president of the Massachusetts Institute of Technology, as educational director for the new army training corps which is being created under the auspices of the department's committee on education and special training. This announcement is made in Washington coincident with the statement that the work of the corps is now in full swing, and that three summer camps were opened July 18 for professors and advanced students in colleges who will take part in the student training corps next fall. The committee has called three conferences to formulate detailed regulations under which the army training corps shall be administered. The three summer camps are established at Plattsburg, N. Y., Fort Sheridan, Ill., and Presidio, Cal.

Marconi Business.—During 1917 the business of the Marconi International Marine Communication Company increased by nearly 100 per cent in gross revenue, according to the directors' report, which has just been issued. The gross revenue for 1917 amounted to £470,657, an increase over the preceding year of £200,476. This increase was derived principally from rentals of additional ships fitted. However, it is pointed out that necessary restrictions in respect of private messages at sea have continued and prevented revenue being received from this source.

Norwegian Government Adopts Electric Trucks.—After careful investigation, says A. Jackson Marshall, secretary Electric Vehicle Section, National Electric Light Association, the Norwegian government has placed initial orders with American manufacturers for fifty heavy-duty electric trucks to be used in various communities for the distribution of food. Water powers are plentiful in Norway, and as a result energy for electric vehicle charging is available in large quantities at small cost. The electric vehicle successfully competed with the "gas" car when gasoline cost 15 cents a gallon and energy 5 and more cents per kilowatt-hour. The superiority of the "electric" in Norway is evident now, when gasoline, when available, costs $1 or more per gallon and energy about 2 cents per kilowatt-hour.

Indiana Commission's Work.—The Public Service Commission of Indiana, on completing its first year's work under the reorganization of May 1, 1917, presented a brief report showing the work accomplished during the fiscal year. At the beginning of the year the formal docket consisted of 634 open cases on formal docket May 1, 1917, and 884 cases filed during the year ended April 30, 1918, making a total of 1518 cases pending in a year. Of this number 1442 cases were disposed of during the year, leaving only 76 cases open. The war's abnormal conditions resulted not only in an unprecedented filing of formal cases, but at least 100 per cent more complaints were received. Most of these were disposed of immediately outside the records. In addition to these there were disposed of in the informal docket 542 adjustment cases and 140 inspection cases, making a total of 682 informal cases disposed of. Added to the formal docket cases this makes a total of 2124 docketed cases disposed of during the year. Moreover, the year began with 634 cases open and closed with only 76 cases pending. In making this report the commission stated that it felt it was in a position to handle to-day's business to-day.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Local and Special Acts.—An act of 1910 providing that existing rates of a utilities company for supplying water, gas and electric light to a certain city should not be thereafter increased without the consent of the mayor and common council is a local and special act, the Court of Appeals of Maryland held in Mayor and Common Council of Westminster vs. Consolidated Public Utilities Company (103 A. 1008). In view of the law creating the Public Service Commission and constituting it a body for determining rates of public utilities companies, and repealing all laws in conflict therewith, the act of 1910 prohibiting increase in rates of the Westminister utilities company without the consent of mayor or common council was invalid, as in violation of Constitution, Article 3, 33, prohibiting enactment of a special law for any cause for which a general law of the state makes provision.

Obligations of Long-Term Contract.—The code of 1907, empowering a municipality to contract for furnishing electricity to a city or town, authorizes a municipality to contract for its inhabitants for a fixed and reasonable period, and such contracts are protected under the inviolable contract clause of the state and federal constitutions, the Supreme Court of Alabama held in Mobile Electric Company vs. City of Mobile (79 S. 39). A contract under authority of the code between a municipality and an electric company to furnish light and energy to the city for ten years, and fixing maximum rates for supplying citizens, "to remain in force perpetually," though void in so far as it makes the rate perpetual, will be enforced during a period of thirty years in analogy to constitution, 1901, 228, limiting terms of franchises to that period. A bill by a municipality to enjoin an electric company from increasing its rates and from depriving the subscribers who failed to pay the increased rate, while in the nature of a bill for specific performance of a contract, does not call for the continuous performance thereof through a series of years and is not therefore without equity. A city may maintain a bill to enjoin an electric company from increasing rates as to its citizens, notwithstanding that the citizens could redress the wrong individually or collectively, the object being to prevent a possible loss or inconvenience to them by non-compliance with the contract between the city as the representative of the consumers and the company to furnish light, the company being a public service corporation.

John Fisher has been appointed chief engineer of the Western Light & Power Company, Boulder, Col., succeeding A. Jordine.

H. T. Reuler has been appointed chief engineer of the Atchison (Kan.) Railway, Light & Power Company, succeeding H. C. Bryant.

Durham Evans has been promoted to succeed Sam Browne as superintendent of the Gainesville district of the Georgia Railway & Power Company.

Sam Browne, superintendent of the Gainesville district of the Georgia Railway & Power Company, has resigned and has entered the government service.

D. A. Roberts has been appointed superintendent of the Southern Illinois Railway & Power Company, Harrisburg, Ill., succeeding C. F. Richardson, resigned.

George E. Foster has been appointed electrical superintendent of the Schenectady Power Company, Schaghticoke, N. Y., to succeed Raymond D. Sherman, resigned.

E. G. Shore, local superintendent for the Mount Whitney Power & Electric Company at Porterville, Col., has resigned to take charge of the electrical work of H. R. Parsons.

H. E. Drevenstedt, for the last three years general superintendent of the Salem (Ohio) Electric Lighting Company, has resigned to become connected with the General Utilities & Operating Company, Baltimore, Md.

Alfred C. Wilson, who has been assistant engineer of the electrical department of the Georgia Railway & Power Company, Atlanta, Ga., has been promoted to engineer of the department, succeeding J. O. Hardin, resigned.

C. F. Richardson, formerly superintendent of the Southern Illinois Railway & Power Company, Harrisburg, Ill., has resigned to become assistant general superintendent of the Indiana Railway & Light Company. Before going to Harrisburg late in 1912, he was superintendent at Brazil, Ind., of the Terre Haute, Indianapolis & Eastern Traction Company.

J. O. Hardin has resigned as engineer of the electrical department of the Georgia Railway & Power Company, Atlanta, Ga., to become electrical engineer for Lockwood, Greene & Company, Boston, Mass. Mr. Hardin will remain in Atlanta in charge of the Southeastern district. He joined the power company forces in 1912, having previously been employed by the General Electric Company.

Paul P. Haynes of the Public Service Commission of Indiana has been appointed a member of the special war committee of the National Association of Railway and Utilities Commissioners, with headquarters in New York City. Mr. Haynes succeeds Max Thelen, chairman of the Railroad Commission of California, who has resigned to become surveyor of contracts in the War Department, with offices in Washington, D. C.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

H. H. Hermes, manager of the new-business department of the Oklahoma Gas & Electric Company, Oklahoma City, Okla., has been appointed illuminating administrator for the State of Oklahoma.

Lieut. Fulton Mandeville, formerly of the commercial department of the Louisville (Ky.) Gas & Electric Company, has been promoted to the rank of captain in the 327th Machine Gun Battalion of the Lincoln Division. Captain Mandeville was graduated from the officers' training camp at Fort Benjamin Harrison last year and received a commission as first lieutenant.

Thomas A. Wynne, president-elect of the Indiana Electric Light Association, is vice-president and treasurer of the Indianapolis Light & Heat Company. Mr. Wynne, as chief engineer for the Indianapolis company, has been responsible for many developments, including the planning of extensions to the main generating station of the company, the use of storage-battery auxiliaries and the construction of a large subaqueous coal-storage pit. He has also been very prominent in the Jovian Order, having been Jupiter for the 1916 term and previous to that Jovian Statesman for Indiana.

H. U. Wallace, for the past six years vice-president and general manager of the Western Light & Power Company, with headquarters at Boulder, Col., has resigned and accepted appointment as major in charge of engineering and construction, Quartermasters' Department, with headquarters at Washington, D. C. Mr. Wallace was at one time chief engineer of the Illinois Central Railroad and general manager of the Lake Shore Railroad. He was appointed receiver of the Denver, Laramie & Wesler Railroad when that system got into financial difficulties a little more than six years ago.

Halford Erickson, formerly chairman of the Railroad Commission of Wisconsin and recently of the firm of Hagenah & Erickson, Chicago, has been elected vice-president of the Louisville Gas & Electric Company, Louisville, Ky. Prior to becoming a member of the Wisconsin commission in 1905, when it was organized, Mr. Erickson was for nine years Labor Commissioner of the state. He was born in Sweden, where he received his early education. In 1884 he came to the United States and took his academic training in Minneapolis, Minn. In 1890 he entered the employ of the Chicago, St. Paul, Minneapolis & Omaha Railroad, where he remained for six years.

William Bennetts has been appointed electrical superintendent of the Western Light & Power Company, Boulder, Col., succeeding Harley Hard, resigned.

C. J. Peterson, who has been connected with the Stillwater (Minn.) division of the Northern States Power Company for eight years as hydroelectric superintendent, has been appointed general superintendent, succeeding C. J. Clarey.

J. N. Mahoney, for twelve years a member of the engineering department, has tendered his resignation from the Westinghouse Electric & Manufacturing Company, to open consulting offices in New York. For the last eight years Mr. Mahoney has been in charge of designing switches, fuses and circuit breakers for the Westinghouse company, and he is largely responsible for progress that has been made in this class of apparatus. Previous to this work he was connected with the railway engineering department in charge of control design. Mr. Mahoney is a member of the American Society of Mechanical Engineers, the American Society of Mining Engineers, the American Institute of Electrical Engineers and the American Electrochemical Society.

D. A. Hegarty has been appointed vice-president of the Western Light & Power Company, with headquarters at Boulder, Col., succeeding H. U. Wallace, resigned. Mr. Hegarty was formerly vice-president and general manager of the Little Rock (Ark.) Railway & Electric Company, general manager of the New Orleans (La.) Railway & Lighting Company when it was operated by Ford, Bacon & Davis, general manager of the Houston (Tex.) Lighting & Power Company, and since last year was again in the service of Ford, Bacon & Davis, working on appraisals, reports, increased fare and rate cases. Mr. Hegarty has taken an active part in the American Electric Railway Association, being formerly president of the transportation and traffic division, and has been a member of committees of the National Electric Light Association and also of the Association of Municipal Improvements. In 1917 he was elected first vice-president of the Southwestern Electrical and Gas Association.

Obituary

Ray Tompkins, for seventeen years president of the Elmira (N. Y.) Water, Light & Railroad Company, died at his home in Elmira on June 30.

John D. Peck, president of W. K. Ostrander & Company, died last week at his home in Brooklyn, N. Y., at the age of sixty-seven years. Mr. Peck had been at the head of this business for thirty-five to forty years, and when the business was incorporated about fourteen years ago he was elected president. Mr. Peck was born in Connecticut.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

NEW ENGLAND MARKET FOR ELECTRIC RADIATORS

Fuel Administration Asks Boston Householders to Use No Coal for House Heating Prior to Dec. 1— Other Places May Be Included

Far-seeing jobbers are now making plans to handle an increased number of electric radiators this fall, in view of the threatened coal shortage facing the country. A very significant ruling was made a few days ago at Boston by the Fuel Administration for New England. Householders in the city proper have been asked to use no coal for residence heating until Dec. 1. New England is about 6,000,000 tons short on steam coal, and while anthracite has been coming into the market fairly well this summer, the outlook is very serious for the winter supply.

Last winter the electric radiator market was virtually sold out at times in Boston, and in some cases it was necessary to send a jobbers' representative to the factories in order to obtain anything like a satisfactory number of equipments for the retail trade. Even at the current cost of energy for lighting service, the electric radiator was widely used in the extreme weather of last winter to take off the worst chill in bathrooms, bedrooms and even in living rooms.

Long before Dec. 1 the weather in New England grows sharp, and there is every prospect that the central station will be called upon this fall to supply energy to radiators as a means of mitigating the severities of late autumn. It is expected that the ruling regarding the use of coal for residence heating will have to be extended to other places than Boston, and the necessity of house heating from some source is so inescapable that unless central-station service is greatly curtailed the demand for electric radiators is likely to exceed that of last year by a large percentage.

SHORTAGE OF SPOOLS FOR MAGNET WIRE AND LEAD CABLE

Explanations of the Low Stocks—Ordinary Trade Accumulations Fail to Meet Demand— Metal Devices Substituted

Attention was recently called to what may be considered a minor but is yet an important phase of the electrical trade in the rather acute shortage of spools for magnet and annunciator wire. The shortage is ascribed to various causes. A great deal of magnet wire has been exported, but the spools were not expected to be sent back, as is the custom in the domestic trade. The war created a heavy demand abroad, but the restraint recently placed on exportations, even to neutral countries, has reduced this business to a minimum. Attempts to ship magnet wire in coils proved a failure and were abandoned, as the insulation was affected by moisture during the sea voyage and the rough handling in stowing and discharging cargo. Spools had therefore to be employed with the package wrapped in metal casing.

The practice is to charge the full value of spools in the invoice, with credits given when they are returned. Ordinarily the spools were shipped back within a few weeks, but with the freight congestion six months and more would pass before they reached their destination. A year ago the spool shortage was more acute than now. Conditions at the present time, however, are such that the market is being combed to obtain a sufficient supply. Some wire manufacturers and distributers are experiencing more difficulty than others in gathering a sufficient assortment of spools to meet the demand, and this may possibly lead to a higher price for magnet and annunciator wire.

Substitutes for brasswood and pine spools are being used with marked success. Two large Eastern manufacturers are using a copper-plated steel spool with a welded reinforced head which far outlasts the wooden kind and is claimed to be safer and more economical in the long run. A compressed-paper spool has also been tested, but though answering for small weights of about 5 lb., those who have given it a trial say it does not serve for 50 lb., the usual quantity sold the trade.

A shortage of reels for lead cable also exists in some quarters of the manufacturing field. As the government now controls the output of lumber, assertions are made that this is the basic reason for the curtailment in the supply. A recent government order called for reels made up on special specifications for which a priority order had to be obtained to secure the particular lumber designated. It has been said, moreover, that the government is buying cable reel and all. As a result the reels are not as a rule returned to the jobber.

DIFFICULTIES EXPERIENCED IN HANDLING GOVERNMENT ORDERS

Cost of Checking and Hunting Up Items Is Found to Make Much of the Business of an Unprofitable Character

So much of the business of electrical concerns is of a war nature that any change from the customary way of doing business is necessarily of considerable consequence to the manufacturers and jobbers. Particularly in this connection the methods so far employed by the government in handling orders come up.

The difficulties experienced, especially by the electrical jobber, who handles such a multiplicity of government orders for shipment to so many different places at a narrow margin of profit, are finding expression very frequently.

A few of the points in question are here outlined and indicate how the practices differ from those regularly employed in commercial transactions.

Notwithstanding the quantities of detailed instructions on government orders, the most important instruction to the seller to whom goods are to be charged apparently receives little or no attention.

When government vouchers are returned to jobbers or manufacturers for their receipt they seldom show the order or requisition numbers on which they apply. In this case it is very difficult, especially where the number of orders runs large, to identify the charge and to keep the accounts checked on the ledgers.

On the other hand, a check when sent in not infrequently shows a voucher number. Since, however, it is seldom that the number is contained in previous papers so that it can be recorded, it is of small value or none in identifying the invoices which the check is supposed to cover. As a rule checks bear the phrase "For switches" or "For electrical supplies," or something of a similar nature. There are, however, so many like orders, especially where the entry does not have some outstanding feature such as

size, that it is a particularly trying job to search out the right order.

Furthermore, checks are received marked "War Department" or "Treasury Department," but inasmuch as a concern trading with the government in any volume will probably have several branches under these headings, checks so marked offer no further clew to the identification of the order. This is more evident in those cases where such a check is sent to cover a number of invoices, and where occasionally it has been subject to a reduction because of rejected material of which the seller has received no previous notification.

Another difficulty experienced by those dealing with the government is in connection with the lost bills, cases of which are very numerous. Furthermore, a large number of government orders specify that original bills of lading shall be surrendered with invoices. When this is done and the bill lost the seller has no original receipt on which a claim can be made, and as a result a considerable amount of time is consumed in making the collection which under ordinary commercial practice would not occur.

As stated in the beginning, a concern, especially an electrical supply jobber, that monthly is making large numbers of shipments to a great many different army, navy and other government designations, each made up of a mass of small articles, often finds the margin of profit under such conditions inadequate.

A suggestion has been made that many of these difficulties and others would be minimized if the government should adopt a standard form of order blank with a special order number according to the segregation of the accounts.

METAL MARKET SITUATION

Official Copper Price Continued at 26 Cents Until November 1—Tin Lower

Of particular importance this week is the announcement from Washington, with confirmation by the President, of the continuation of the 26-cent price for copper until Nov. 1. Consumers had complained that too much instability would result in a too frequent change in official price and that consequently they would not be so anxious to look ahead very far for copper stocks. It was decided therefore that hereafter all contracts placed for future delivery of copper should be made stipulating the price as of date of shipment and date of placing order. As soon as the announcement regarding the official price had been made public there were many orders placed. The government is understood now to have enough copper in sight to serve its requirements.

Spelter has stiffened somewhat, while tin, on the other hand, in anticipation of the government price under the prevailing market, is selling for less than it has during the past month. Scrap metals were in better supply.

NEW YORK METAL MARKET PRICES

	Aug. 6	Aug. 13
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26.00
Casting	Govt. price 26.00	Govt. price 26.00
Wire base	29.25	29.25
Lead, trust price	8.05	8.05
Antimony	13.00 to 13.25	13.50 to 13.75
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	Govt. price 15.00	Govt. price 15.00
Spelter, spot	8.35 to 8.50	8.80 to 8.90
Tin, Chinese *	92	91.00
Aluminum, 98 to 99 per cent.	Govt. price †33.10	Govt. price †33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	23.50 to 24.50	23.50 to 24.50
Brass, heavy	14.50 to 15.00	14.50 to 15.00
Brass, light	11.50 to 12.25	11.50 to 12.25
Lead, heavy	7.12½ to 7.50	7.12½ to 7.50
Zinc, old scrap	5.50 to 5.75	5.50 to 5.75

* No Straits offering. † In 50-ton lots or more; carload, 33.10 cents per lb.; 1-ton to 14-ton lots, 33.20 cents per lb.

THE WEEK
IN TRADE

GENERALLY speaking, the trade seems to be marking time until the officials at Washington clear up certain matters. The conduit situation is now pretty generally understood, and stock is everywhere short. The hot weather has apparently made no reduction in the total sales volume. Fans have moved pretty rapidly in the East, but not so well elsewhere.

Labor for the week was remarkably stable in comparison with previous weeks. There is, however, a very acute shortage, particularly in jobbing establishments. Those remaining find it necessary frequently to work late into the night in order to clean up the day's work.

A few changes in price have been noticed, but these have either been due to local conditions, such as taking care of large freight charges, or else are belated advances. The keeping of copper at 26 cents may deter some manufacturers from increasing prices until after Nov. 1, when copper again comes up for consideration. Inasmuch, however, as all contracts for copper hereafter will be based on price at delivery, buyers may reasonably expect to see many electrical lines go over to this practice. Some have been doing this for some time.

NEW YORK

New York has just gone through a record hot spell, but, unlike last year, there was no apparent let-up in business. Jobbers are doing a large business and report that in the neighborhood of 90 per cent of it was war business of some sort. This percentage will undoubtedly increase as the government requirements absorb more and more of the available raw materials.

Building is at the lowest ebb yet, with no indications of an increase. New apartment houses are badly needed. The week showed virtually no change from the preceding one. Prices were unaltered and deliveries seem generally to show no better treatment.

FANS.—The extraordinary hot weather of the previous week resulted in a rush for fans. It now seems that the market will be as bare of fans this year as it was at the end of the 1917 season. Both alternating-current and direct-current fans were in demand. Owing to the purchases by the government there were not so many direct-current oscillators available this year for general distribution. During the past hot spell the volume of sales was mostly in the smaller sizes, principally because the earlier sizes had gone off the shelves earlier in the season.

CONDUIT.—While conduit, along with other iron and steel products, has for some time been on the priorities list, it is understood that the regulations regarding its supply have been greatly stiffened during the past ten days. There appears to be conduit available for war work. There seems little likelihood at the present time of any conduit being released for other construction work.

SECOND-HAND APPARATUS.—A very brisk market prevails for motors and generators of over 50-hp. rating. Utilities, mainly in the Middle West and the South, are making inquiries in the local market for used generators. Smaller apparatus has been quiet for the past two months. The supply of used equipment is becoming considerably harder to find. However, much of the equipment coming on the market does not appear to have been used very much. Occasionally, of course, some real old apparatus turns up.

LAMPS.—In spite of the many factors that are acting to curtail lighting, the demand for lamps at this season is

keeping up with that of last summer. All of the "Mazda" lamp manufacturers are making strenuous efforts to push local distribution by establishing agency outlets. This is following naturally upon the announcement of the lamp merchandising policy of the New York Edison and the United companies. Local stocks of standard sizes appear to be satisfactory at present, although one prominent manufacturer is firmly convinced that a shortage will follow.

WIRE.—Copper wire remains unchanged in price as a result of the continuation of the 26-cent copper price until Nov. 1. Prevailing rubber-covered for this week is 34 cents.

CHICAGO

While the copper producers did not get their expected increase at Washington on Aug. 7, prices in general have not remained stationary in the Central Western territory. The trend is still sharply upward. Volume of business remains about the same in spite of the fact that this is the open season for vacations. A great deal of interest is centered on the activities of the United States Fuel Administration, and attempts are being made to foresee what the effect will be on certain classes of trade. One responsible representative of this body said this week in a public address that 75 per cent of the 1,000,000 kw. of turbine capacity now building in the United States, and intended largely for Eastern central stations, would be diverted to places where it is needed in the Central West because it would be impossible in the East to get the coal to run the turbines even if they were installed. This statement, if it is correct, presages a rapidly increasing industrial activity for the Central West because the War Industries Board will surely place additional government work in territory where the power supply is ample. The Fuel Administration's active part in helping to close inefficient isolated plants and to interconnect large generating systems is expected to create a considerable additional demand for tie-line equipment and stokers. At the same time, this work will probably place in the second-hand market many small engines, generators and boilers. The government's policy on incandescnt lamps, which will soon be announced, is expected to increase the demand for tungsten lamps of smaller sizes and to decrease the demand for carbon and "gem" lamps. Maintenance material for ice plants will no doubt sell earlier this year than usual if the Fuel Administration carries out its plan to centralize ice production as soon as cooler weather will permit it.

STANDARD PORCELAIN.—There has been a general revision upward in porcelain prices. While formerly there were a great many classifications, this has been changed so that now one set of discount applies to tubes and another to all other standard goods. The advance amounts to between 10 per cent and 15 per cent.

HARDWARE.—Pole-line bolts, braces and the like have increased in price between 20 per cent and 25 per cent.

GLASS INSULATORS.—Jobbers have advanced the price on glass insulators an additional 10 per cent this week.

SCHEDULE MATERIAL.—There are so many facts to consider in connection with the advanced cost on Schedule I material that jobbers have not yet definitely fixed the amount of advance this material will carry.

FANS.—Twice fans have taken a spurt, but the arrival of cool lake breezes each time prevented the movement from attaining anything like the desirable proportion.

CONDUIT.—In industrial plants and new power houses it is now becoming common to see temporary open wiring and to have it explained by the statement that conduit cannot be secured.

COAL-HANDLING MACHINERY.—Small concerns making inexpensive coal-handling machinery for central stations and industrial plants have grown large over night owing to the demand for their goods.

HOUSE-WIRING MATERIALS.—Housing problems are beginning to confront more and more Middle Western cities, creating a demand for house-wiring materials.

BOSTON

Little change is to be seen in the volume of business from week to week. Jobbers are constantly rushed to fill war and essential orders, and the principal difficulty seems to be to obtain the necessary material and supplies from the manufacturers. It looks as though congestion would be the rule and not the exception on the railroads for months to come. Jobbers on the coast are able in some cases to utilize the New York-Boston steamship service to advantage, but only a small percentage of the total "imports" into New England from other sections can be handled in this way. There is some talk about extending the so-called "return-load" system of truck service, which has attained such extensive development in Connecticut, into eastern Massachusetts. Prices are remarkably steady at present and collections are reasonably good.

Labor conditions are less disturbed in the electrical field, a second strike at the Lynn works of the General Electric Company having been nipped in the bud by the refusal of the War Industries Board examiners to continue their inquiry if employees remained away from the shops. Stocks are fairly large in staple lines, but more and more the jobber is finding it no easy matter to obtain reliable deliveries, and consequently he has to carry far more of an investment than would be the case under normal conditions. The central stations are sitting tighter than ever as regards new construction and commercial development work. The momentum of past campaigns and the intrinsic appeal of electrical products, however, continue to yield very fair sales returns.

WIRE.—Wire is quoted on a 34-cent base at Boston. Government business predominates, without much change in the market. Jobbers are now at work in the effort to capture some of the wiring supply business associated with the construction of houses for war workers in various parts of New England.

CONDUIT.—Spasmodic shipments are coming in, but the general market is very much restricted. Odd lots may be picked up now and then, but whoever starts out to-day to purchase pipe without a priority order or its equivalent is likely to be disappointed in short order.

ELECTRIC LOADING MACHINES.—The demand for these equipments is remarkably good. There has been no recent price change, and deliveries depend largely upon plant capacity. Motors for these equipments are now readily obtained. The Concord Machine Company, Concord Junction, has now sold five equipments for the coal-handling service at Camp Devens.

FARM-LIGHTING SETS.—A good summer business is reported, with excellent prospects for fall trade. Prices have held steady since March, and it is not expected that a further increase will be required for the present. The demand for 3-kw. sets exceeds the local supply.

ELECTRIC RANGES.—Despite the absence of any extended advertising a very good electric range business is being handled. The threatened coal shortage is a factor in this, together with the food-saving characteristics of a well-run installation. One range sells another in a given neighborhood, and a steady increase in installations is noted.

DRY CELLS.—Sales of flashlamp cells are in excellent volume, and the supply is very satisfactory at present. Dry cells of ordinary types are moving well, with steady prices. The recent increase of about 12½ per cent in the price of flashlamp cells of a prominent type does not appear to have affected the market much.

POLE-LINE MATERIAL.—The small amount of new construction being handled by the central stations has enabled the jobbers to build up substantial stocks of this equipment for immediate shipment. Most of the recent buying has been in connection with war-plant service.

SECOND-HAND MOTORS.—Stocks are very well filled in the sizes up to 50 hp. or thereabouts. A good deal of repair work is under way.

INDUSTRIAL ELECTRIC TRUCKS.—Deliveries of from three to eight weeks were quoted in an opening of bids for government pier service. Prices are firm.

ATLANTA

Reports received from various sections of the Southeast would indicate that the volume of business continues heavy, with the possible exception of a few lines that are beginning to show a sagging off. This is to be expected, as residential and other building permits are down to a low ebb. Present construction is mostly along government or quasi-government account. Each day witnesses a curtailment in all lines other than essential. This condition is reflected in the demand for electrical materials ordinarily used for this work.

Deliveries covering steel products seem to be growing longer, and it is almost impossible to secure anything for non-essential work.

The Birmingham Coke & By-products Company has been organized, with a capital of $3,000,000, for the manufacture of solvent ammonia, naphtha and other chemicals. The entire output of this plant has been contracted for by the United States government. It is reported that the Baldwin Locomotive Works will establish a plant in Birmingham, Ala. Plans have been completed for the first unit at Kingsport, Tenn., covering a half-million-dollar chemical plant. During the last few weeks a large amount of capital has been invested in coal mines, and as the production of coal is behind normal requirements, these plants will be rapidly developed and electrical equipment for them will secure a high priority rating. The American Lumber Company of Florida, formerly the German-American Lumber Company, has recently purchased turbine and motor equipment costing $30,000. The government has big plans under way covering the expansion of this plant, but definite information is not available at this time.

SCHEDULE MATERIAL.—Jobbers report that the ordinary demand for this material has dropped off decidedly of late, owing to the fact that very little house wiring is being done, and no building to speak of, for some time ago the government requirements were very heavy, and the market to-day is spotty as the demand depends a great deal on cantonment expansion. Shipments are slowing up.

FLASHLAMPS.—The volume of sales appears to be decreasing. Factory shipments are very poor, which jobbers state is due to a slowing up of production at the factories.

FANS.—The increase in temperature of the last few days, as compared with that experienced during the past week, has tended to create an active market for fans, and they are moving briskly. There appears to be ample stock on hand to supply requirements.

HEATING APPLIANCES.—With the exception of flatirons, this class of material is dormant this week, possibly owing to the fact that a 10 per cent advance in prices was registered Aug. 1.

SEATTLE—PORTLAND

In spite of the between-season period jobbers and dealers report unabated activity in business. Northwest jobbers state that sales volumes equal if they do not exceed the past two weeks. Domestic sales have been especially satisfying, while shipyard volumes are maintained at the usual high standard. Domestic sales were featured by heavy movement of washing machines and other labor-saving devices. Business curtailment as result of war conditions is imminent, and the prospect is causing some anxiety. Difficulties in securing certain much-needed stocks, including steel, conduit, etc., are increasing and are augmented by requirements that stocks in many lines must be obtained on government order. Portland jobbers report that sales of motors in that district to shipbuilding companies continue at a fair rate owing to steady expansion of yards. The electrical equipment for arc welding recently installed in Portland shops is filling a long-left want. Other electrical labor-saving devices, such as special motor-driven machines for turning ship bars and surfacing ship timbers, are proving extremely satisfactory.

The spruce division recently issued specifications for a large electrically operated sawmill to be installed at Toledo, Ore. The conduit situation in Portland is precarious owing to scarcity of stock and to recent orders restricting sales.

Practically every city in the Northwest, with the exception of Spokane, reports a tremendous gain in amount of new building, especially resident construction, advancing strides in Portland being particularly noted. Seattle's home-building campaign, for which plans are now being perfected, shows prospects of surpassing expectations. Taking advantage of favorable weather conditions, the lumber mills of Oregon and Washington are speeding up operations to meet government demands for fir and spruce. Continued activities in wooden shipyards requiring heavy quantity of lumber are expected. Pacific Northeast sash and door factories are to be closed by government within two weeks, so that more clear fir can be had for airplane stock.

SAN FRANCISCO

Business is good, although all signs point to the fact that the demand in essential electrical lines will soon far exceed the supply available, as is already the case with conduit and its allied material. There is a preponderance of power projects in new work reported. Further economy in the use of electricity in many essential branches is secured by lightless Mondays and Tuesdays in the stores and by recommendations to householders.

APPLIANCES.—Dealers report a better movement in small cooking utensils. A new "Majestic" radiator is being prepared for the fall trade on the line of the original model but capable of angle adjustment.

SEWING MACHINES.—Indications point to a vigorous campaign for the fall. The scarcity of help and the nation's trend toward economy will intensify previous demands, which will also be raised by the perfected Red Cross organization. A recent advance in Western Electric machines of $2 list is reported, making the vibrating or standard model now sell for $41.50 f.o.b. Pacific Coast points.

LAMPS.—Eastern factories are far behind in their delivery, and scheduling and apportioning of orders on even more drastic lines are anticipated. It is conservatively reported that the average Pacific Coast shipyard breaks 250 lamps per day, so that mere maintenance is enormous. On automobile lamps small deliveries will be almost impossible.

LAMP CORD.—Local stocks are good and demand fair, except for weatherproof and desk cords. It is understood that orders for these shipbuilding cords are now subject to priority certificates at the factory.

PORCELAIN.—Various adjustments in the selling prices of small knobs, tubes and cleats are reported to comply with existing freight conditions, this advance tallying about 10 per cent for standard pieces. The city of Oakland has passed an ordinance permitting the use of knobs and tubes in entrance wiring for residences, so as to compensate for the conduit shortage and to release conduit for urgently needed government work.

SWITCHES.—It has been reported that one or two interior California cities have been considering the use of open switches on account of the steel shortage, but nothing definite has been done, nor is sentiment with such a move. A 10 to 25 per cent advance in the price of patented inclosed safety switches has become effective, but the demand continues great. The general sale of open switches, however, is less than that of last year because of the drop in the amount of residential work, and the lack of heating campaigns prevalent last year has this year been compensated for to a certain extent by pumping work caused by the drought.

FANS.—The interior of California, the source of most of the fan demand, is now in the height of the hot season, but so far fan sales have been very disappointing, and they are likely to remain so.

RANGES.—Some encouraging work in the sales of electric ranges is reported from the Hawaiian Islands. Some good orders have been cabled in and those on the ground report good ground on which to build future sales.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List Per 1000 ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	12½%—57.25
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	12½%—66.75

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	12½%—97.75
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	12½%—126.80

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20% to List
Coil to 1000 ft	5% to 15%
	No. 12 Solid
Less than coil	+20% to List
Coil to 1000 ft	5% to 15%

Twin-Conductor

	No. 14 Solid
Less than coil	$115.00 to $80.00
Coil to 1000 ft	98.80 to 75.00
	No. 12 Solid
Less than coil	+20% to +5%
Coil to 1000 ft	5%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	12%
1/5 to std. pkg	20%
Std. pkg	44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to 12%
1/5 to std. pkg	List to 20%
Std. pkg	25% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35—.36	.35—.36
50 to barrel	.31—.32	.32—.33
Barrel lots	.28—.289	.29—.299

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.319 to .322	.329 to .332
Barrel lots	.289 to .292	.299 to .302

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
⅜	250	$5.00
½	250	7.50
¾	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00— 82.50	$69.75— 75.00
⅜-in. double strip	75.00— 82.50	72.00— 75.00
½-in. single strip	100.00—110.00	93.00—100.00
½-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00 to $78.75	$63.75 to $71.25
⅜-in. double strip	78.75	71.25
½-in. single strip	100.00 to 105.00	75.00 to 95.00
½-in double strip	105.00	93.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
⅜	$0.05½	1	$0.25
½	.06	1¼	.33
¾	.09	1½	.40
¾	.12	1¾	.47
¾	.15	2	.55
¾	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
⅜-in.—	25.00–55.00	24.00–24.45	21.50–23.00
½-in.—	30.00–60.00	27.00–27.28	23.50–26.00

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
⅜-in.—	$60.00	$30.00	$26.50
½-in.—	$65.00	$32.50	$29.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb	7% to 12%	10% to 15%
2500 to 5000 lb	9% to 14%	12% to 17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb	+5% to 6.8%	+3% to 8.8%
2500 to 5000 lb	9.8 to +20%	11.8% to list

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5.00 to $6.00
Discount	30%

CHICAGO

List price	$5.50 to $6.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$5.00 to $5.50
1/5 to std. pkg	4.50 to 4.75

Standard packages, 500. List, each $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$7.00
1/5 to std. pkg	$5.15 to 5.75

Standard packages, 500. List, each, $0.07

LAMPS, MAZDA

105 to 125 Volts

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.30
60-watt—B	100	.35
100-watt—B	24	.70
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.77
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	List
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	List
Std. pkg.	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.20—$35.90
Coil to 1000 ft.	26.95— 27.18

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$35.00
Coil to 1000 ft.	26.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24.00

CHICAGO

Net per 100	$21.75 to $30.00

OUTLET BOXES

Nos.	List, Per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25% to 33%	20% to 27%
$10.00 to $50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$21.00 to $38.00
1/5 to std. pkg.	17.85 to 19.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$16.80 to $24.15
1/5 to std. pkg.	15.80 to 21.00

Standard package, 2200. List per 1000, $20.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net Std. Pkg. 3500 Std. Pkg. 4000 5½ N.C.—Solid Nail-it—N.C.

Less than 1/5 std. pkg.	$16.00 to $20.50	$32.00
1/5 to std. pkg.	13.60 to 15.60	27.20

CHICAGO

Per 1000 Net. Std. Pkg. 3500 Std. Pkg. 4000 5½ N.C.—Solid Nail-it—N.C.

Less than 1/5 std. pkg.	$11.70 to $18.40	$33.85 to $36.80
1/5 to std. pkg.	$10.15 to $16.00	26.60 to 32.00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10% to +10%
1/5 to std. pkg.	5% to 8%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List to 10%
1/5 std. pkg.	16⅔%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100 amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+5% to Net
$10 to $25 list	11% to 15%
$25 to $50 list	14% to 20%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16% to 25%
$15 to $50 list	24% to 28%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+15% to +5%
$10 to $25 list	11% to List
$25 to $50 list	5% to 14%
	Low Grade
Less than $10 list	+5% to 5%
$10 to $25 list	8% to 16%
$25 to $50 list	24% to 28%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+10%
1/5 to std. pkg.	5% to 8%
Std. pkg.	23% to 25%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10% to 20%
1/5 to std. pkg.	List to 16⅔%
Std. pkg.	25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	40% to net	30% to net
$2.00 to $10.00 list	10% to 50%	5% to 40%
$10.00 to $50.00 list	20% to 60%	10% to 52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list.	25% to 40%	15% to 30%
$2.00 to $10.00 list.	25% to 50%	15% to 40%
$10.00 to $50.00 list.	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00
Discount	30%

CHICAGO

List price	$6.00 to $6.50
Discount	25% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.434—$0.4625
No. 18, full spools	.384— .4425

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.65 to $0.69
No. 18, full spools	.55 to .575

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15.00–$20.00	$12.50–$15.00	$11.00–$11.25
12	21.29– 27.10	19.35– 23.20	17.05– 17.42
10	29.70– 37.80	27.00– 32.40	23.75– 24.30
8	41.90– 53.35	38.10– 45.70	33.35– 24.29
6	60.30– 84.40	54.27– 72.35	51.55– 53.05

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$19.00–$21.00	$14.00–$16.00	$12.50–$13.25
12	27.53– 28.70	23.86– 28.70	22.02– 24.50
10	33.02– 40.10	30.48– 40.10	27.44– 34.23
8	46.09– 56.50	42.54– 48.23	38.99– 41.34
6	91.18– 91.30	61.76– 77.84	52.18– 66.72

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net	
Less than 25 lb.	$37.75	$38.40
25 to 50 lb.	36.40	37.75
50 to 100 lb.	32.40	36.75

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$37.00 to $39.72
25 to 50 lb.	36.00 to 38.72
50 to 100 lb.	35.00 to 37.72

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

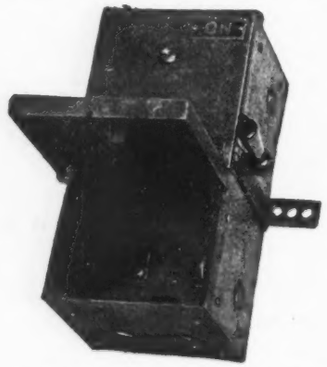
Lamp of Many Uses

What is known as the "U-Ti-Lite" lamp, adapted to a number of purposes, has been developed and placed upon the market by the Peerless Light Company, Halsted, Adams and Green Streets, Chicago, Ill. The lamp may be utilized in any position and can be attached to supporting fixtures by means of tight-grip clamps of the rubber-clad spring type. When not in use the clamps fit into the base. The rubber-protected base permits its use on any highly polished surface without fear of scratching. The metal base is of such size and weight that the lamp will not readily tip over. A swivel permits adjusting the lamp to any angle, while the metal shade is mounted so that it can be turned to give the best concentration of light.

Safety Switch for Industrial Use

A double-door cabinet is the feature of the "Maco" safety switch that has been placed upon the market by W. A. McCombs & Company, Union Arcade Building, Pittsburgh, Pa. These two cabinets are separated by a fiber partition, one space holding the fuses and the other holding the switches. It is impossible to get into the fuse compartment of the switch until the switch is in the "off" position, or to close the switch until the fuse compartment door has been closed. The door over the switch compartment is held closed with a lock.

All switches are arranged for a quick break, the operating mechanism being part of the operating yoke and not of the quick-break attachments on blades of the switch. This feature makes the switch very rugged. Provision is made for locking the switch in the "off" position with three padlocks, thus permitting three men to work on the same line.

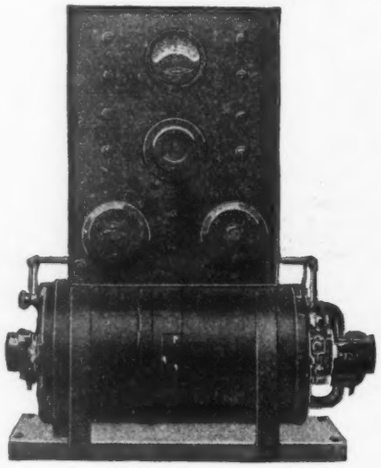


BARRIER PREVENTS ACCIDENTAL CONTACT WITH LIVE PARTS

A standard type A switch is used in the box, and should replacement be necessary any type A switch may be installed with very little trouble. This allows the steel cabinet to be used indefinitely.

Battery-Charging Sets for Auto Batteries

Motor-generator sets with or without control panels are being manufactured by the Perfection Storage Battery Company, Rhodes Avenue and Fortieth Street, Chicago, for charging low-voltage storage batteries. The motors are supplied for standard alternating-current or direct-current circuits and the generators for ratings of 85 watts to 300 watts and pressures of 7 volts to 40 volts. The generator is shunt-wound with a rising characteristic and will produce the correct tapering charge. As shown in the accompanying illustration, the outfit is mounted on a base on which is also mounted the switchboard control panel.



MOTORS AND GENERATOR ON COMMON BASE WITH CONTROL PANEL

Pipe-Bending Machine

When bends must be made in conduit care has to be taken to prevent deformation of the tube and to avoid sharp bends, otherwise trouble will be experienced in pulling in the cable. Furthermore, the material must not be damaged since the protection afforded by the conduit would be sacrificed thereby. Likewise, for pipes carrying water or steam, the friction will be increased by poorly made bends. With the hand-operated pipe-bending machine made by the American Pipe Bending Machine Company, 37 Pearl Street, Boston, these difficulties are avoided, the makers say, and the work does not require skilled men.

PIPES MAY BE BENT RAPIDLY AND WITHOUT INJURY WITH THIS DEVICE

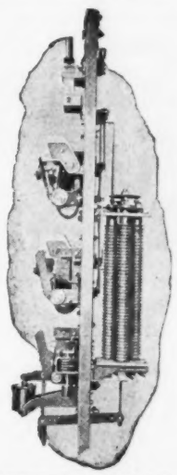
The machine includes a vise in which the pipe or conduit is clamped and a wheel with a concave rim around which the pipe is bent by a roller attached to a long lever. Bends of different curvature can be made by changing the forming wheel and adjusting the position of the roller on the lever. Among the features of the machine are (1) that the pipe can be bent in a horizontal direction, (2) that the framework is made of pipe and is therefore relatively light, (3) that it can be set up quickly. Similar machines are made for bending tubes and solid bars.

Automatic Motor Starters

For automatically starting alternating-current motors of the polyphase squirrel-cage type that require a gradual start the Allen-Bradley Company, 495 Clinton Street, Milwaukee, Wis., has developed a starter of the primary resistance type. This starter, known as the type KD, consists of two magnetic switches and a variable magnetically operated resistor. These starters are made in four forms, consisting of different combinations of overload relays and a knife switch.

The operation is as follows: When the pilot circuit, through which these switches are controlled, is energized it operates a double-pole magnetic switch, which connects the motor to the line through a variable resistance of the graphite compression type. This re-

sistance is of such value that an initial current of about full load will flow. Simultaneously with the closing of this first clapper, the operating mechanism of the variable resistance is set in mo-

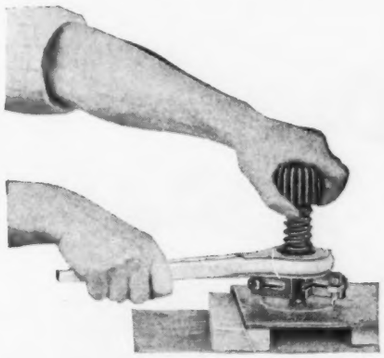


MOTOR STARTED SLOWLY BY SERIES OF MAGNET SWITCHES

tion, which gradually cuts the resistance out of the circuit and accelerates the motor to full speed. The operation of this resistance mechanism is controlled by means of an oil dash-pot which is adjustable. When this operating mechanism reduces the resistance to the minimum it closes the operating circuit of the second clapper switch, which shunts the resistance entirely out of the circuit, thus putting the motor directly across the line. The circuit which shunts out the resistance is closed through fuses or overload relays, and at the same time the first clapper switch is opened, thus introducing the overload protecting devices.

Adjustable Tool to Cut Holes in Sheet Metal

To reduce the labor of cutting holes in steel cabinets, boilers or tanks or in other materials such as slate, marble or fiber, a tool has been developed which is known as the "Jiffy" adjust-



NEAT AND FAST METHOD OF CUTTING CIRCULAR HOLES IN VARIOUS MATERIALS

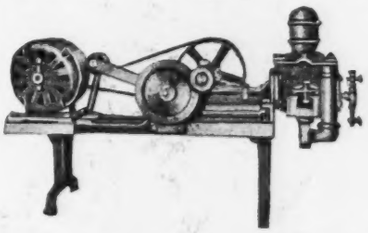
able cutter. It consists of a steel casting on which are mounted two cutting tools. The steel casting is rotated by means of a ratchet wrench, pressure being applied to the cutting tools by means of a heavy coil spring. The device is held in place by a round stud with a flanged nut which is placed in a ⅜-in. (0.96-cm.) pilot hole in the metal.

The tool is made in two sizes, each of which is adjustable within certain limits. The No. 1 type is used for cutting holes 1.25 in. to 3 in. (3.2 cm. to 7.6 cm.) in diameter. The No. 2 cuts holes from 1⅝ in. to 6 in. (9.6 cm. to 15.2 cm.). The No. 12 is a combination of the No. 1 with the swing chuck of the No. 2, thus making the cutting range 1.25 in. to 6 in. in diameter.

The tool can be operated in positions otherwise usually inaccessible because of its ratchet feature and its "flat" design. Furthermore, work can be done much faster and neater with it than by the old method of cutting holes with a hammer, cold chisel and punch. This device is being marketed by Koch & Sandige, 19 South Wells Street, Chicago, Ill.

Electric Force Pump for Residences

For all domestic purposes, water system service, etc., the Peters Pump Company, Kewanee, Ill., has placed upon the market a force pump which it claims has a very high efficiency. The



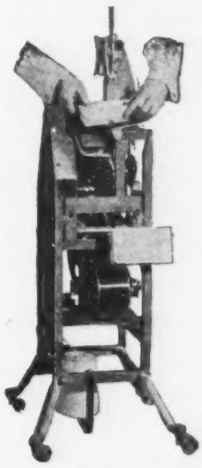
SILENT AND EFFICIENT HOUSE PUMP

makers also say that this machine is silent in operation, powerful, compact and reliable. It may be adapted to wells or cisterns up to 25 ft. (7.6 m.) vertical lift. The pump is driven by a repulsion induction motor with 200 per cent full load starting torque, the power being transmitted by means of a back gear with a ratio of 3 to 5, which permits operation at large overloads.

If desired the machine can be provided with a two-pole automatic switch complete with fuse plugs and cut-out which is accurate, simple and easy to connect. This is set to cut in at 20 lb. (1.4 kg. per sq.in.) pressure, and cut out at 45 lb. (3.2 kg. per sq.cm.) but is adjustable to any desired pressure.

Package-Tying Machine

Improvements have been made recently in the letter-tying machine manufactured by B. H. Bunn & Company, 9970 Charles Street, Chicago, and described in the Sept. 27, 1913, issue of the ELECTRICAL WORLD, which give it a much bigger field of usefulness. It is used for tying and sorting mailing matter in convenient bundles for ready handling, giving high speed and uniform results. Instead of handling letters of only one size, a single tying machine is now used for an endless

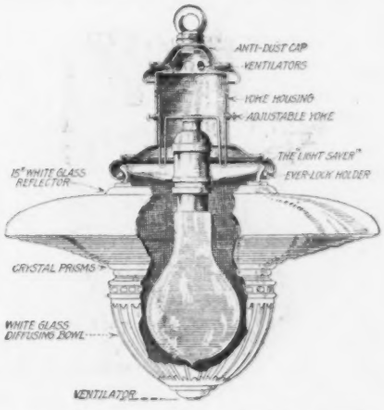


EFFICIENT MEANS OF TYING MAIL

variety of catalogs and other circular matter. Machines are being supplied to the War Department and the Department of Agriculture at Washington, and a special machine is being sent to the Treasury Department for tying heavy packages of Liberty bonds.

Fixture Adaptable to Different Sizes of Lamps

A grip holder which does away with the set screws usually required to hold the diffusing shade of the lamp and an arrangement for quickly adjusting it for the use of 100, 200, 300 or 400-watt lamps are features of a commercial lighting fixture manufactured by C. G. Everson & Company, 70 West Lake Street, Chicago. The fixture is known as the "Mon-o-lier," and for it the manufacturer claims high efficiency in light distribution. It is said to be particularly adaptable for lighting stores,



SET SCREWS ARE NOT USED IN THIS FIXTURE

factories, banks, auditoriums or other large interiors. As may be seen from the illustration, the bowl of the fixture is made up of a 15-in. (38.1-cm.) white-

glass reflector above and a white-glass diffusing bowl below, the two being connected by a series of prisms. Ventilation is obtained through a hole in the bottom of the white-glass diffusion bowl and through ventilators in the top of the shade holder.

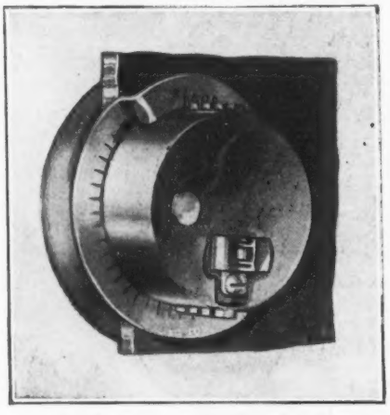
Motor-Driven Compressor Plants

Economical installations can be made by use of an A-F-S motor-driven stationary compressor plant where floor space is available, according to the maker, the A-F-S Machine Company, Toledo, Ohio.

This plant is equipped with electric control for automatically stopping and starting the compressor so that constant air pressure may be maintained. The crank case of the compressor is entirely closed, making it dust and dirt proof. The crank case and air cylinder are separate pieces, thus permitting easy access to the piston, rings and connecting rod. Light quick-acting poppet valves are also in the intake, while ball valves requiring no regrinding are used for the outlet or discharge. This combination of valves gives the highest possible efficiency, according to the maker. The compressors may be driven either by belt or high-speed chain.

Accurate Self-Winding Electric Clock

An electric clock which, it is said, will give correct time continuously has recently been placed upon the market by the Connecticut Clock Company, 929 Singer Building, New York City. The clock winds automatically from a storage battery or dry cells, and an ordinary dry cell will operate it. The clock contains a seven-jewel compensated movement which is so mounted that, according to the makers, it cannot be seriously affected by vibration. The

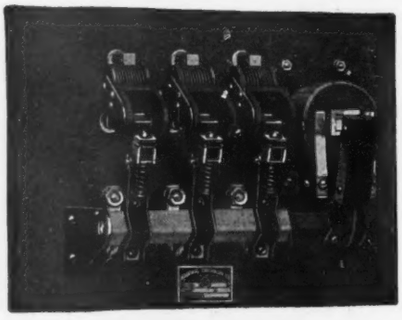


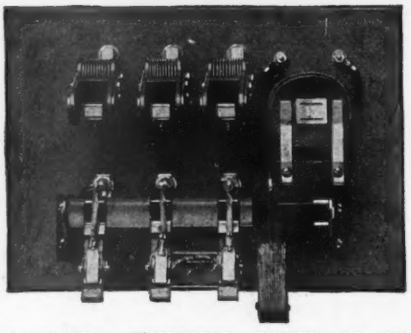
ELECTRIC CLOCK WHICH CANNOT BE SERIOUSLY AFFECTED BY VIBRATION

case is compact and fitted with the "Connecticut" lock ring which prevents it from jarring loose from its support.

Alternating-Current Magnetic Contactor

For controlling power and light circuits the Industrial Controller Company of Milwaukee, Wis., has placed upon the market two types of alternating-current magnetic contactors—two-pole and three-pole. Each switch is mounted on a square shaft at one side of the closing magnet, the shaft being held by a bearing at either end. This contactor is so designed that by the removal of a small U-shaped clamp the magnet armature may be slid along the shaft and the contactor opened widely, permitting free access for the removal of the coil, contacts, etc., in





MAGNETIC CONTACTOR CLOSED AS IN OPERATION AND OPEN FOR REPAIRS

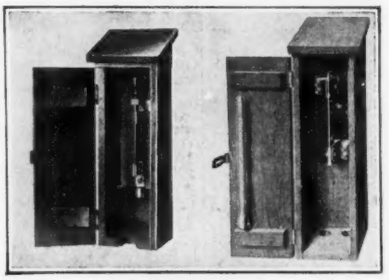
case repairs or replacements are necessary.

The magnet armature is arranged so that by automatic action it properly seats against the pole piece of the magnet, which arrangement practically eliminates all humming and vibration in the contactor and requires no bearing adjustment when assembling. These contactors are manufactured in 30, 75 and 150-amp. sizes.

Low and High-Voltage Pole-Line Switches

Line-sectionalizing switches recently developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., for high-voltage installations, are shown in the accompanying illustration. These switches embody several safety features. The box holding the lower-voltage switch is so designed that when the switch is opened the switch handle drops into a slot in the bottom of the box. This allows the door of the box to be closed and locked, thus making the closing of the switch by persons unauthorized to do so impossible.

The switch of Fig. 2 is a heavy-type service switch inclosed in a wooden box



FIGS. 1 AND 2—750-VOLT AND 1500-VOLT LINE SWITCHES

which can be locked with the switch either opened or closed. This switch is operated by an insulated hook stick which is separate from the switch. It is hung inside the box cover when not in use. The smaller of these line switches is for voltages up to 750 and for capacities of 200, 400 and 600 amp. The heavy switches are for voltages up to 1500 and capacities of 1200 amp.

Extensible Pipe-Grounding Clamp

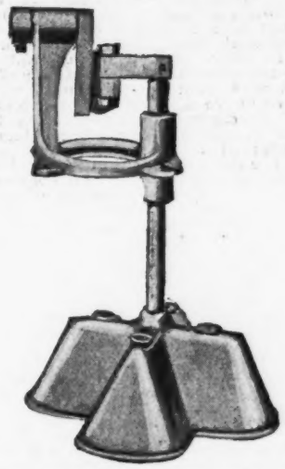
A convenient pipe clamp for making electrical "ground" connections is being marketed by the Charles M. Rose Company, 136 Prince Street, New York. A strap of annealed copper, fastened to the bolt at one end, is drawn around the pipe and secured at the other end by passing through a slot in the lug and being bent back upon itself. To accommodate pipes of diameters from ⅜ in. to 2½ in. (0.95 cm. to 6.25 cm.) more or less of the strap is drawn through the slot in the lug. One-inch (2.54-cm.) extenders are used for larger pipes by placing the burred eyelet through the hole in the end of the strap and hammering the two pieces together. As many extenders may be

ONE STANDARD LENGTH OF STRAP AND ONLY 1-IN. EXTENDERS NECESSARY

used as may be necessary for large pipes. The tinned lug for receiving the ground wire lies snugly against the pipe.

Attachment for Dolly Washer

The vacuum producer illustrated herewith is made for attaching to washing machines manufactured by the Globe Manufacturing Company, Perry, Iowa. The four-leaf-clover-shaped cup



VACUUM WASHING MECHANISM KEEPS CLOTHES IN MOTION ALL OF THE TIME

or vacuum producer is made of heavy cast iron and is electro-galvanized. In this cup are four valves which let out the air on the downward stroke and which close on the upward stroke, thus making the cup air-tight. This produces a vacuum which draws the soapy water through the clothes. The four movements of this mechanism in operation are as follows: Downward, forward, backward and upward. This motion is calculated to move all of the clothes in the tub.

Adjustable Lamp for Shops

To assist the mechanic who must direct light into places difficult to reach, the Herwig Art Shade & Lamp Company, 2140 North Halsted Street, Chi-

PORTABLE LAMP STAND OF GREAT FLEXIBILITY

cago, has developed the adjustable portable unit shown herewith. With this cast-metal stand, which is suitable for factories as well as garages, the lamp may be adjusted to various heights. It can be made low enough to go under an automobile or other machine and throw light upward or it can be adjusted to place the lamp 4 ft. 10 in. (1.47 m.) above the floor. To give this great degree of flexibility the stand, which is mounted on casters, is provided with an upright lamp support made of two pieces. This upright carries the extension arm, which can be swung freely around the pipe upright, and a universal joint at the end of the arm has a double-acting ratchet and swivel movement, which allows the lamp to be set at any angle. Thirty feet (9.1 m.) of cord is supplied.

Electric Coffee Grinder

To meet the requirements of a small grocer, the Enterprise Manufacturing Company of Philadelphia, Pa., has placed upon the market a new line of rapid grinding coffee mills, a type of which is shown in the accompanying illustration. The machine is fitted with a ¼-hp. motor directly connected to a

WILL GRIND 1½ LB. PER MINUTE

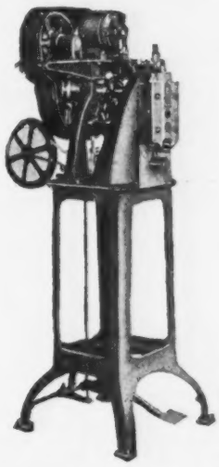
shaft of the cutter. It can grind 1.5 lb. (0.67 kg.) of coffee per minute and can be regulated to grind coarse or fine while in operation. The device is fitted with granulating grinders only, and can be used with either direct or alternating current.

Box-Corner Staying Machine

By simply attaching a plug to an ordinary lighting socket, a box corner staying machine manufactured by the M. D. Knowlton Company of Rochester, N. Y., can immediately be placed in service. The machine is operated by a Westinghouse motor mounted on the top of the frame of the machine and geared directly to it. Because it is supported on caster wheels the machine can be readily moved about the factory.

It is claimed that the corner formed by this machine is stronger than the original board on account of the great pressure used and the fact that the board is neither punctured nor weakened by the continuous fastening.

A feature of the machine which is of special interest is the Knowlton safety device which replaces the old-style link in the machine head. It serves a double purpose of a pressure transmission and of a protection to the operation. The safety device is designed in such a manner that when the head



SAFETY DEVICE PREVENTS PRESSURE EXCEPT AT PROPER TIME

is lowering there is no driving connection until the head comes within a distance of approximately 5/32 in. (0.4 cm.) of the anvil. Any obstruction thicker than this prevents the device from locking and exerting pressure.

Electric Washing Machine with Safety Wringer

An electric washer of the dolly type has recently been placed upon the market by the Empire Electric Manufacturing Company, Kansas City, Mo. This machine has a cypress tub supported by stave legs. It can be equipped with electric motors for either 30 or 110-volt service. The gears are covered to prevent injury to the operator, and a safety device is provided on the wringer which allows it to be stopped instantly.

Small Lighting Sets

Compactness, simplicity, ruggedness and minimum weight are the features claimed for the small lighting sets that are being manufactured by the Steam Motors Company, Inc., Springfield, Mass. These sets are furnished for the Emergency Fleet Corporation vessels and consist of a generator and steam turbine mounted on one base. The fact that there are only two bearings helps to produce smooth operation and eliminates misalignment and vibration troubles. The total over-all length of a 10-kw. set is 3 ft. 3 in. (0.99 m.) and the net weight 1150 lb. (521 kg.).

The turbine has a horizontal split casing with steam inlet and exhaust in the lower half. Only one turbine packing gland is necessary because an improved type of labyrinth packing is used. These sets are made in capacities from 3 kw. to 50 kw.

Trade Notes

Government Orders

The following orders have been placed by the various government departments:

ORDNANCE DEPARTMENT — General Electric Company, Schenectady, N. Y., compound-wound d.c. motor; Charles A. Templeton (Inc.) Waterbury, Conn., electric detonators; Chicago Pneumatic Tool Company, Philadelphia, heavy-duty electric drills; Mechanical Appliance Company, Milwaukee, Wis., motor-generator sets; Packard Electric Company, Warren, Ohio, rubber-covered high-tension cable; Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., electric motors.

NAVY BUREAU OF SUPPLIES AND ACCOUNTS — July 22, Wetmore-Savage Company, Boston, Mass., slow-burning wire; Ideal Electric & Manufacturing Company, Mansfield, Ohio, generating set. July 23, Worcester (Mass.) Electric Manufacturing Company, switchboards; Mutual Electric & Machine Company, Detroit, Mich., panels. July 25, Bailey Eelectric Supply Company, New York, wire. July 26, General Electric Company, Schenectady, N. Y., searchlamps; Standard Underground Cable Company, Pittsburgh, Pa., lighting wire. July 30, Standard Underground Cable Company, Pittsburgh, Pa., copper cable; Eck Dynamo & Motor Company, Belleville, N. J., motors. July 31, Standard Underground Cable Company, Pittsburgh, Pa., wire; Indiana & Insulated Wire Company, Jonesboro, Md., cable.

GOVERNMENT ORDERS, BUREAU OF AIRCRAFT PRODUCTION.—Dyneto Electric Corporation, Syracuse, N. Y., 100 battery-charging sets; Alien Property Custodian, Washington, D. C., 10,000 Splitdorf magnetos; Ward Leonard Electric Company, Mount Vernon, N. Y., 200 battery charging panels; Standard Underground Cable Company, Pittsburgh, Pa., 193,680 ft. of cable; John A. Roebling's Sons, Trenton, N. J., 21,000 ft. of cable; Manhattan Electrical Supply Company, Jersey City, N. J., 6100 connectors; General Radio Company, Cambridge, Mass., 2500 receiving sets; Western Electric Company, New York, N. Y., 280 amplifiers, 300 transmitting sets, service development of two high-power output amplifiers, telephone supplies, etc., and cable; American Propeller & Manufacturing Company, Baltimore, Md., 100 air fans.

BUREAU OF AIRCRAFT PRODUCTION, —July 11, De Forest Radio Telegraph & Telephone Company, New York City, 2000 SCR-54-A radio sets; Western Electric Company, New York, ten wavemeters. July 13, Marconi Wireless Telegraph Corporation of America, New York City, 1500 wireless sets; Liberty Electric Corporation, Port Chester, N. Y., 2000 radio sets. July 15, Disco Electric Manufacturing Company, Detroit, Mich., 1000 synchronizing generators. July 16, Western Electric Company, New York City, development of special equipment; Disco Electrical Manufacturing Company, Detroit, Mich., 5310 synchronizing generators; General Electric Company, Schenectady, N. Y., 25,000 regular tubes, 30,000 ballast lamps; Standard Underground Cable Company, Pittsburgh, Pa., 18,000 ft. cable. July 18, Western Electric Company, New York, N. Y., 10,000 radio sets. July 18, Western Electric Company, New York, electrical supplies, 1500 splicing clamps, 320 grips, 17,612 bridle rings; Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., 2000 airplane radio-telegraph transmitting sets; International Radio Telegraph Company, Brooklyn, N. Y., 2000 airplane radio-telegraph transmitting sets. July 19, Western Electric Company, New York City, 10,000 antenna systems. July 25, Western Electric Company, 463 West Street, New York, N. Y., 10,000 head sets, complete with plugs and cords; Dyneto Electric Corporation, Syracuse, N. Y., 55 electric generating sets.

HOLLAND AND DENMARK COMMODITY LIST.—The War Trade Board has announced the adoption of a set of regulations with respect to the exportation of certain commodities to Holland and Denmark. A list of commodities which will be given consideration is appended to the announcement. No electrical goods are specified with the exception of lighting fixtures. In this case only those made up of iron or steel will be considered.

TRADING WITH THE ENEMY.—Accumulative supplements to enemy trading lists, revised, containing additions, removals and corrections from March 15, 1918, to July 12, 1918, have been issued by the War Trade Board.

BRITISH FOREIGN TRADE CONTROL. —The Bureau of Foreign and Domestic Commerce has recently issued current series No. 39 entitled "British Control of Imports and Exports," with list of prohibitive goods. Copies of the pamphlet may be obtained from the Superintendent of Documents at the Government Printing Office, Washington, D. C., at a price of 5 cents.

MUST NOT PURCHASE FOR EXPORT PRIOR TO ISSUANCE OF LICENSE.— It is the policy of the War Trade Board to discourage and prevent exporters purchasing, manufacturing or producing articles for the fulfillment of specific export orders until an appropriate export license has been issued. The attention of the War Trade Board has been directed to a number of instances in which manufacturers before obtaining export licenses have made articles for specific export orders which were useless for domestic consumption but which under the regulations of the War Trade Board could not be exported. It is essential for the proper conservation of commodities in the United States that this practice be stopped, and it is the purpose of the War Trade Board to refuse licenses to exporters who violate this policy.

LARGE QUANTITY OF WOOD-STAVE PIPE.—The desirability of wood-stave pipe is again officially recognized by the United States government as evidenced by the placing of a further order with the Continental Pipe Manufacturing Company, Seattle, Wash., for 230,000 ft. of machine-banded wood-stave pipe, varying in size from 6 in. to 18 in. in diameter. It will require more than one hundred railroad cars to deliver this order. This pipe is being made of Douglas fir lumber, already world-famous for its many uses in supplying the war needs of the United States and its allies. It will require more than 1,000,000 lb. of wire and 1,500,000 ft. of lumber to complete this one order. The three large plants of the Continental Pipe Manufacturing Company in the Douglas fir belt of Oregon and Washington have previously furnished pipe on government orders amounting to 200 miles, or 625 carloads.

SPLITDORF ELECTRICAL COMPANY LICENSED TO USE ENEMY-OWNED MAGNETO PATENTS.—The Federal Trade Commission has announced that it has licensed the Splitdorf Electrical Company of Newark, N. J., to use in the manufacture of magnetos certain patents hitherto exclusively used in this country by the Bosch Magneto Company, but found by the commission to have been owned or controlled entirely by Robert Bosch of Stuttgart, Germany. The Bosch company, an American corporation, in opposing the grant of licenses to Splitdorf, presented evidence to show Robert Bosch in 1913 had agreed to sell the patents to the Bosch Magneto Company for $275,000. From the evidence submitted, however, it appeared that the legal title is still held by Robert Bosch, and the patents stand in his name in the U. S. Patent Office. The commission, therefore, held the patents are enemy-owned or controlled, and as such subject to licensing to American firms. The Splitdorf company is manufacturing magnetos for army airplanes and was directed by the War Department to embody the Bosch devices. Splitdorf engineers contend their own devices are equal to or superior to the Bosch devices specified by the army, but have modified their magnetos to conform with the government specifications. The licenses are non-exclusive, and are to run during the duration of the patents.

SHIPMENTS TO OR THROUGH THE UNITED KINGDOM, FRANCE, ITALY AND BELGIUM.—The War Trade Board, after consultation with the United States Food Administration, the United States War Industries Board and the war missions of the respective European allied governments, announces the adoption of a simplified procedure, effective Aug. 12, 1918, for the issuance of export licenses for shipments which are destined to the United Kingdom, France, Italy or Belgium (excluding their colonies, possessions and protectorates), either directly or by way of any other country or colony, or destined to any country or colony by way of the United Kingdom, France, Italy and Belgium, excepting shipments destined to Switzerland by way of France or Italy. The purposes of the new procedure are to save ship tonnage and to prevent the useless consumption of material and labor by preventing the manufacture of articles which may not be exported or which the government of the country of destination does not wish to have imported. Application for such licenses now must include one of each of the following papers, properly executed: (a) An application on form X, to which should be attached (b) such supplemental information sheets as may be required by the rules and regulations of the War Trade Board to be used in connection with shipments of certain commodities or shipments to certain countries (as form X-1, X-2, etc.); (c) a new supplemental information sheet, form X-115. In form X-115 the applicant is required to give certain information and make certain agreements in conformity with the purposes above mentioned. Applicants must also show thereon that permission to import or purchase (if required) has been duly granted by the government of the allied country to or through which the shipment is to be made. Applications for licenses to export to France must have attached thereto a copy of the French government "attestation." Applications filed with form X-115 attached should be mailed directly to the War Trade Board, Washington, D. C. They will then be referred by the War Trade Board to the war mission of the allied country to or through which the shipment is to be made and to the United States War Industries Board or to the United States Food Administration, if necessary, and these applications will be considered by the War Trade Board in accordance with its rules and regulations. This will relieve applicants for export licenses from the necessity of applying to the war mission, to the War Industries Board or to the Food Administration, as required by War Trade Board Ruling No. 104.

Western Electric Company Changes

LEO M. DUNN, manager of the Philadelphia house, has been appointed assistant Eastern district manager. The Philadelphia and Pittsburgh houses will be under his supervision. He recently was appointed manager of the Philadelphia house after serving in a like capacity at Pittsburgh for five years. Mr. Dunn has been with the company since 1910.

FREDERICK H. LEGGETT, manager of the New York house, succeeds Mr. Clifford as Eastern district manager. He will have supervision of New York, Philadelphia and Pittsburgh. Mr. Leggett has been working for the company for twenty years, beginning in the clerical department in New York. Since that time he has spent three years in Tokyo as secretary of the Nippon Electric Company, Ltd., has been manager at Antwerp, foreign sales manager at New York and Pacific district manager at San Francisco.

E. P. CLIFFORD has been appointed office manager of the engineering department, West Street, New York City, reporting to the chief engineer and having supervision over the clerical branch, the employment division, the medical division, the restaurant and the financial division. Mr. Clifford has been with the company since November 14, 1892, when he began as an office boy in the clerical department in New York. He was made chief clerk shortly afterward and remained in that position until 1902, when he went to Chicago as chief clerk. He was transferred to Philadelphia in 1903 and a year later was back in Chicago doing clerical inspection work. After several years in that position he became manager of the New York house and Eastern district supervisor, and in 1917 he was promoted to the position of Eastern district manager.

THE NEW PROCESS SPECIALTY COMPANY, Milwaukee, Wis., has moved from the Enterprise Building to its new factory at 230-232 Hanover Street. This move was necessitated to provide greatly increased facilities for the manufacture of high-grade jigs, dies, gages, tools and special machinery.

C. A. BIRD has been placed in charge of the new Pittsburgh office of the General Devices & Fittings Company, Chicago. This office is at 1303 Arrott Building. Mr. Bird has done much research work in the line of high-tension phenomena and has prepared many papers on conductor calculations and allied engineering subjects. He was formerly one of the district engineers of this company's Cleveland office and while there had charge of Pittsburgh district work. Increasing demand for engineering service made it necessary to station Mr. Bird in Pittsburgh with a suitable staff of assistants.

J. H. FENTON of the Los Angeles office of the Westinghouse Electric & Manufacturing Company has recently been appointed manager of the industrial division of that office, which includes jurisdiction over the Tucson and El Paso offices.

THE BOOTH-HALL COMPANY, 565 West Washington Boulevard, Chicago, Ill., has contracts for building Booth-Hall electric steel furnaces for the following companies: Consumers' Steel Company, Chicago, Ill., one 3-ton furnace for producing tool steels; Ecorse Foundry & Machine Company, Ecorse, Mich., one 3-ton furnace for producing steel castings. This makes a total of ten Booth-Hall furnaces installed and building.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY has this week advised the trade that it has permanently discontinued the manufacture of armored cable, armored cord and flexible steel conduit, its schedules "X" and "Y." This step, the company states, was taken in order that it might devote its entire energy to other lines, including a large amount of government business, both direct and indirect, as well as its "safety service" externally operated line of knife switches. In taking this step the company has canceled all orders for the above materials now in its works, and no further orders, of course, will be taken.

SHIPPING BOARD OFFICIALS TALK TO HURLEY EMPLOYEES

At a recent loyalty meeting of the Hurley Machine Company, Charles Schwab, E. N. Hurley and Charles H. Piez, officials of the Federal Shipping Board, addressed the workers.

E. P. DILLON, manager of the power division, New York office of the Westinghouse Electric & Manufacturing Company, has resigned to become general manager of the Research Corporation of New York. Mr. Dillon joined the Westinghouse company in 1909, having been previously connected with various mining and electrical companies in Colorado. In 1917 he was transferred to the New York office as manager of the railway and power division. For several years he was assistant to manager of the railway and lighting department at East Pittsburgh, being in charge of power house and apparatus work. He was transferred to the New York office as manager of the railway and power divisions in 1917.

THE AJAX ELECTRIC SPECIALTY COMPANY, 1408 Morgan Street, St. Louis, Mo., has just been organized to manufacture specialties and represent manufacturers of staple electrical merchandise and novelties. The Ajax Electric Specialty Company will be headed by Ernst Alschuler, president, who was recently sales manager for the American Carbon & Battery Company and also for many years Chicago manager for the Interstate Electric Novelty Company. James S. Cuming is vice-president and treasurer. He has disposed of his interest in the Central Telephone & Electric Company, of which he was the organizer in 1898, and had been president since that time. Oscar Walters is secretary. He has been in charge of the manufacturing interests of the Central Telephone & Electric Company for the last twelve years.

Trade Publications

POLE-LINE ACCESSORIES.—Additions to catalog handbook No. 9 are now available, W. N. Matthews & Brother of St. Louis, Mo., announce.

TANKS.—Specifications of tanks are now listed in a bulletin, No. 246, dated July 25, put out by the Walter A. Zelnicker Supply Company, 325 Locust Street, St. Louis, Mo.

SAFETY SWITCHES.—W. A. McCombs & Company, Union Arcade Building, Pittsburgh, Pa., have issued a folder describing and illustrating their safety switch for industrial use.

EXPANSION JOINTS.—Expansion joints are described and illustrated in a circular distributed by the Ross Heater & Manufacturing Company, 504 Mutual Life Building, Buffalo, N. Y.

AIR AND GAS MIXER.—In a folder called "McKee Proportional Mixer" the Eclipse Fuel Engineering Company, Rockford, Ill., shows how its gas-mixing device is applied to furnaces, etc.

COMPUTER.—In the circular distributed by the Computer Manufacturing Company, 25 California Street, San Francisco, the Ross Meridi-O-Graph and the Ross Rapid Computer are illustrated and described.

HEAT-INSULATING BRICKS.—A folder which may be secured by addressing the Armstrong Cork & Insulation Company, Pittsburgh, Pa., explains the economy of using its insulating bricks in furnaces and ovens.

POWER PLANT APPARATUS.—Surface condensers, multi-head water heaters and expansion joints, etc., are illustrated and described in a circular issued by the Ross Heater & Manufacturing Company, Inc., Buffalo, N. Y.

TOGGLE SWITCH.—Toggle snap switches, schedule F, are illustrated and described in a leaflet that has been printed by Harvey Hubbell, Inc., Bridgeport, Conn. This switch, listed as No. 8101, conforms to the National Electrical Code.

ELECTRICALLY OPERATED BRAKES.—Brakes for use with elevators and hoists where the supply is alternating current, together with dimensions of equipment, are covered in booklet A, distributed by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

LAMP SOCKETS.—"Dim-A-Lite" lamp sockets are illustrated in a folder that has been issued for dealer purposes by the Wirt Company, Armat Street, Germantown, Pa. Advance literature for an intensive merchandising campaign has also been issued by this company.

PORTABLE LAMPS.—Regent portable lamps with "Rozelle" and "Ivre" shades are illustrated and listed in a circular distributed by the Ivanhoe-Regent Works of the General Electric Company, Cleveland, Ohio. These decorative portable lamps in soft rich colors are shown to be exceedingly attractive.

COAL-HANDLING MACHINERY.—Standard installations of the Godfrey coal conveyor are illustrated and described in a circular that has been distributed by John F. Godfrey, Elkhart, Ind. Emphasis is laid on the fact that power plants can greatly facilitate continuous operation by storing their coal now.

FANS AND BLOWERS.—A ninety-six-page guide book pertaining to ventilation has been prepared by the Ilg Electric Ventilating Company, Whiting and Wells Streets, Chicago. This company manufactures ventilating equipment for restaurants, schools, theaters, churches, office buildings, homes, industrial plants, etc.

BRONZE GEARED PUMPS.—Bronze geared pumps are illustrated and described in a circular that is being distributed by the M. L. Oberdorfer Brass Company, Syracuse, N. Y. Their adaptability, construction, testing, sizes carried in stock, capacity, tables of dimensions and ratings are shown in this bulletin.

TOOL MARKING.—The Electro-Stylograph Company, 1 Madison Avenue, New York, is distributing a circular describing apparatus for the permanent and convenient marking of tools, gages, dies, etc., by the application of electric energy. It illustrates the tool-room superintendent marking tools with the "Electro-Stylograph" conveniently and permanently.

DUPLEX WIRE SUPPORTERS AND INSULATORS.—A circular describing the L. F. duplex wire supporters and insulators has been issued by Louis Fort, 428 Hoboken Avenue, Jersey City, N. J. Besides giving a description of the insulator, this catalog tells about the interchangeability and mentions the various types. Reproductions of photographs of these fittings are also given.

RUBBER GLOVES.—The Pittsburgh Glove Manufacturing Company, 413 South Main Street, Pittsburgh, Pa., has issued a catalog describing and illustrating its high-tension glove. These gloves consist of a tough extra-flexible rubber of great strength and high dielectric properties, protected by genuine horsehide gloves, according to this bulletin. They permit free and unrestricted use of the hands.

ELECTRICAL DEVICES.—The Western Electric Company, Inc., 195 Broadway, New York, has issued two folders in connection with the Habirshaw and Western Electric Company advertisements that recently appeared in several popular magazines. These circulars and the reproduction of this advertisement illustrate several electrical devices marketed by the Western Electric Company which, it is held, will help in the campaign for new business this fall. Some of the devices shown are drills, grinders, hammers, floodlamps, sewing-machine motors, industrial-type heaters, glue pots, soldering irons, utility motor, vacuum cleaner, hoist equipments, ventilating outfits and inclosed switches.

New Incorporations

THE GILFORD ELECTRIC COMPANY of Hartford, Conn., has been incorporated by E. S. Gilford, B. Gilford and C. Schonhaus. The company is capitalized at $5,000 and proposes to deal in gas and electrical supplies and equipment.

THE ALLIED ELECTRIC COMPANY of Brooklyn, N. Y., has been incorporated with a capital stock of $5,000 to do a general contracting business. The incorporators are L. Weiss, B. Freidman and J. G. Feldman, 357 Third Street, Brooklyn, N. Y.

THE LIONEL CORPORATION of New York, N. Y., has been incorporated by J. L. Cowen, 48 East Twenty-first street; A. T. Scharps, 154 Nassau Street, and M. Frankel, 42 Broadway, New York City. The company is capitalized at $50,000 and proposes to manufacture electric toys.

THE ROCK HILL (S. C.) ELECTRIC COMPANY has been chartered with a capital stock of $2,000 by J. E. Pryor, Minnie R. Martin and others. The company proposes to do a general electrical construction, wiring and repair business of all kinds, and also to deal in machinery.

FRANK E. WATTS, INC., of New York, N. Y., has filed articles of incorporation with a capital stock of $50,000 for the purpose of doing a general electrical and mechanical engineering business. This incorporators are: F. Murdock, W. C. Chapman and A. Pnevin 30 Church Street, New York City.

THE CONTRACTORS' MACHINERY & EXPORT COMPANY of New York, N. Y., has been incorporated by J. N. Morton, W. Catlin, and J. R. Rodriguez, 1140 Jefferson Avenue, Brooklyn, N. Y. The company is capitalized at $100,000 and proposes to manufacture boilers, engines, etc.

THE STRATTON LIGHT COMPANY of Kingfield, Me., has been organized with a capital stock of $10,000 for the purpose of generating and distributing electricity for lamps and motors in the towns of Eustis and Copplin Plantation. The directors are: Edwin H. Gross, president; Forrest R. Wing, treasurer and clerk; Merle A. Bates, William A. Lee and others, all of Stratton.

New England States

TINMOUTH, VT.—Work has been started on the dam in the town of Tinmouth to be situated on the Theophilus Noble farm a short distance from the highway leading east to the Ballard farm, owned by the Hortonia Power Company, which, it is estimated, will create an artificial lake covering approximately 1000 acres and give a storage capacity of 1,200,000 cu. ft. of water.

BOSTON, MASS.—For the purpose of an exchange of electricity between the Edison Electric Illuminating Company and the New England Power Company, it is proposed to connect the plants of the two companies by a transmission line. A petition was filed with the Board of Gas and Electric Light Commissioners by the New England Power Company asking permission to construct a high-tension pole line from the Forest Hills station of the Edison company to the Sudbury dam.

CHATHAM, MASS.—The United States government, Bureau of Yards & Docks, has awarded a contract to the Hixon Electric Company, Boston, for the installation of the proposed new underground conduit system at the local station.

NEWBURYPORT, MASS.—The Newburyport Gas & Electric Company is planning to stretch wires to supply electricity to customers at Ipswich.

NEWBURYPORT, MASS.—The Common Council has passed an ordinance that provides that all wires for the transmission of more than 5000 volts of electricity shall be placed in underground conduits.

NORTHAMPTON, MASS.—It has been decided by the Hampshire County Commissioners to equip the town farm buildings with an electric-light plant.

TURNERS FALLS, MASS.—The Turners Falls Power & Electric Company has awarded a contract to Fred T. Ley & Company, 499 Main Street, Springfield, for improvements to its plant.

HARTFORD, CONN.—The Spencer Turbine Company, 620 Capitol Avenue, has awarded a contract for the erection of a one-story and two-story plant, about 75 ft. by 300 ft. and 40 ft. by 75 ft., on New Park Avenue. R. G. Bent & Company, 904 Main Street, Hartford, are the contractors.

STEVENSON, CONN.—Earle Greene will have charge of the work of building the power house at Stevenson.

Middle Atlantic States

BINGHAMTON, N. Y.—The Binghamton Bridge Company has acquired property at Port Dick, near Binghamton. The company is planning to erect a new hydroelectric plant at the site, to include the construction of a concrete dam and a one-story brick power house and the installation of turbines, generators and other equipment.

BROOKLYN, N. Y.—Plans are being prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for extensions and improvements to the electric power plant at the Brooklyn Navy Yard. An appropriation of $750,000 has been granted for the work.

BROOKLYN, N. Y.—The United States government, Navy Department, Bureau of Yards and Docks, is having plans prepared for improvements to the power plant at the local navy yard.

BUFFALO, N. Y.—Electrical machinery will be installed for operating the draw span in connection with the drawbridge now being erected over the Buffalo River at Abbott Road.

MORRIS, N. Y.—It has been voted to light the streets with electricity. The Lynn Tractor Company will receive the contract for lighting.

WESTFIELD, N. Y.—The Borough Council is considering the construction of a new pumping plant, to cost about $35,000.

DOVER, N. J.—The New Jersey Power & Light Company is making rapid progress in the extension of its electric lighting system to Upper Hibernia. The company will furnish service to the mines, workshops, offices and auxiliary buildings of the Wharton Steel Company.

NEWARK N. J.—The Crocker-Wheeler Company, Ampere, N. J., has had plans prepared for the erection of a one-story addition, about 90 ft. by 90 ft., at North Twelfth Street and Fourth Avenue.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

MORRISTOWN, N. J.—The Morris & Somerset Electric Company plans extensions to its power plant, to cover an area of approximately 18,000 sq. ft. of floor space.

SOUTH AMBOY, N. J.—The City Council has appropriated $6,000 in its annual budget toward an electric street-lighting system.

EASTON, PA.—Work on the installation of the new 10,000-kw. turbine is progressing rapidly and it will be ready for use by Sept. 1.

ESSINGTON, PA.—Plans have been filed by the Philadelphia & Reading Railway Company for the erection of new shop buildings at its Darby Creek yards, Essington, including new engine house, power plant, and other structures. Contract has been awarded to the Robert E. Lamb Company, Philadelphia.

HAZLETON, PA.—The substation of the Harwood Electric Company was damaged by fire on July 30, caused by a bolt of lightning, with loss estimated at about $5,000. The destroyed section of the plant will be rebuilt at once.

PHILADELPHIA, PA.—The Atlantic Refining Company, Passyunk Avenue, has had plans prepared for the construction of a new addition to its boiler plant, about 60 ft. by 95 ft., one story.

PHILADELPHIA, PA.—The Midvale Steel & Ordnance Company, Widener Building, has had plans prepared for the erection of a one-story power plant, to be constructed at the Nicetown works. The structure will cost about $25,000.

PHILADELPHIA, PA.—The C. H. Wheeler Company has awarded a contract for the erection of a new addition to its boiler plant to John N. Gill & Company, Otis Building, to cost $9,000.

PHILADELPHIA, PA.—The boiler plant located at Twenty-first and Clearfield Streets has been acquired by the Pearce Rubber Company for a consideration of about $90,000. The structure is 160 ft. by 230 ft.

PITTSBURGH, PA.—In connection with other improvements at its plant on Belmont Street, near Ridge Avenue, the Crucible Steel Company, Thirty-eighth Street, will build a new boiler plant and make extensions in its ash-handling system to provide for increased operations. Plans for the work, which is estimated to cost about $20,000, have been prepared.

PITTSBURGH, PA.—In connection with the new seven-story factory building to be erected by the Pennsylvania Chocolate Company on Center Avenue, plans have been prepared for a new brick power plant for operation. The company has taken out a building permit for the new structure which are estimated to cost $100,000.

PITTSBURGH, PA.—The Pennsylvania Chocolate Company, Center Avenue, has had plans prepared for the construction of a brick power plant addition to its works in connection with a seven-story factory building, the entire work to cost approximately $100,000.

SOUTH BETHLEHEM, PA.—The Philadelphia & Reading Railway Company is planning to commence work at an early date on the construction of a new engine house and power plant at its local works on Saucon Creek. Plans for the latter structure, which will be about 35 ft. by 75 ft., have been prepared.

SLATINGTON, PA.—The Lehigh Valley Transit Company is making improvements in its traction system from Slatington to Slatedale.

TARENTUM, PA.—Ground has been broken by the board of managers of the Allegheny Valley Hospital for the construction of a new two-story boiler plant at the institution, to cost about $10,000.

BALTIMORE, MD.—Contract has been awarded by the John T. Lewis & Brothers Company of Baltimore, a branch of the National Lead Company, for the construction of its new plant on Columbia Avenue to the McIver Construction Company, Law Building, Baltimore. The cost is estimated at about $1,000,000 and includes a main building, 100 ft. by 300 ft., and several smaller buildings. Shrapnel balls will be manufactured at the plant.

CUMBERLAND, MD.—The American Cellulose & Chemical Manufacturing Company, Ltd., which will erect a plant here, closed a contract with the Edison Electric Illuminating Company to furnish power necessary for the operation of the plant.

HOLDEN, MD.—Archer & Stevens, architects, are preparing plans for the erection of a municipal electric-light plant to cost $30,000.

INDIAN HEAD, MD.—Plans have been prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a cold-storage basin, equipped with traveling crane, etc., at Indian Head, to cost about $125,000.

SPARROWS POINT, MD.—Plans are being prepared by the Penn-Mary Steel Company for the erection of an electric light plant at Sparrows Point, to be operated in connection with the shipyards. The building wil be one story high and of reinforced-concrete and steel construction.

WASHINGTON, D. C.—Bids are to be received by the Bureau of Yards and Docks, Navy Department, for furnishing and installing two surface condensers for a 3750-kva. turbo-alternator, two motor-driven circulating pumps, one motor-driven flushing pump and auxiliary pumps for the condensers on foundations provided by the government at Bremerton, Wash., and at Philadelphia. Specification No. 3085 is to be had of the commandants of the yards.

WASHINGTON, D. C.—The Navy Department, Bureau of Yards & Docks, will erect a new addition to the local boiler plant. Plans for the structure, which it is said will cost about $150,000, have been prepared.

RICHMOND, VA.—A boiler plant to cost $4,000,000 will be built at Richmond, Va., by the Newport News Shipbuilding & Dry Dock Company. The general building contract has been awarded. This contract amounts to $1,000,000, and the main structure will be built of steel and will be 600 ft. long by 160 ft. wide.

SEVEN PINES, VA.—The United States government plans to erect about 1000 houses in Seven Pines, including complete water, lighting and sewer systems. Gannett, Seelye & Fleming, engineers, 204 Locust Street, Harrisburg, Pa., have charge of the project.

North Central States

FLINT, MICH.—The City Council has passed an ordinance requiring the electric wires to be placed underground in certain districts. C. S. Mott, Mayor.

GRAND RAPIDS, MICH.—The Michigan Railway Company will build an electric line from Morrice to Flint. C. E. Morgan, general superintendent, Grand Rapids, Mich.

CANTON, OHIO.—The third unit of the new power plant at Windsor, W. Va., will soon be completed. The electric power supply in Canton, furnished by the Central Power Company, will be materially increased. The plant will cost approximately $3,500,000.

CLEVELAND, OHIO.—The Sixth City Light Company has increased its capital stock from $5,000 to $30,000.

DEFIANCE, OHIO.—The power plant of the Auglaize Power Company will be sold at public auction on Aug. 31 at the Defiance Court House, as a result of the foreclosure of a mortgage held by the Guaranty Trust Company of New York. The plant consists of a huge water-power station 2 miles south of Defiance, and it supplies more than fifty northwestern Ohio towns and several interurban railway lines with electricity.

NELSONVILLE, OHIO.—Improvements to the electric-light plant are contemplated. $2,500 will be spent for same.

STRUTHER, OHIO.—The Struther Furnace Company will spend $500,000 to add to the efficiency of its plant. New electric equipment is included in the specifications.

COVINGTON, KY.—Extensions are being made to the plant of the Kelley-Koett Manufacturing Company on West Fourth Street. The company is manufacturing X-ray machines for the United States government.

ANDERSON, IND.—According to Harry J. Williams, consulting engineer, Dayton, Ohio, the municipal electric light plant must be rebuilt. To enlarge the steam department, larger buildings and general rearrangement will cost about $150,000. To

provide the money will require another bond issue. Seventy per cent of the industries in Anderson are using power from the municipal plant.

COLUMBIA CITY, IND.—Preliminary plans for the abandonment of the municipal lighting plant, including the $17,000 turbine engine, have been started by the City Council.

HAMMOND, IND.—Work on the twenty-four-mill addition to the Gary tinplate plant of the American Sheet & Tin Plate Company, to cost about $10,000,000, has begun.

INDIANAPOLIS, IND.—The Citizens' Gas Company has taken out a permit to cover the construction of its Prospect Street plant. The estimated cost will be $411,000. Among the items of construction will be an addition to the power plant.

PLYMOUTH, IND.—The Plymouth Electric Light & Power Company has filed a petition with the Indiana Public Service Commission to issue $20,000 in preferred stock.

CARMI, ILL.—It has been voted to improve the water and light system at a cost of $6000, for which bonds have been issued.

CHICAGO, ILL.—A special meeting of the stockholders of the Electric Bleaching Gas Company has been called for Aug. 15 to vote on increasing the capital stock from $500,000 to $1,000,000.

MANKATO, MINN.—The Mankato division of the Northern States Power Company has accepted a contract from the Hubbard Milling Company covering 100 hp. in motors.

WORTHINGTON, MINN.—The City Council is considering the installation of an electric light plant and water-works system, to cost about $10,000.

PIERRE, S. D.—Sealed proposals will be received by the city of Pierre, S. D., at its council room, until 7 p. m. Aug. 26 for the furnishing of the necessary labor, material and machinery equipment required to construct a power plant to furnish water for the city of Pierre. Bids will be received on two 200-r.p.m. Unaflow engines for direct connection to 312-kva. alternating-current generators, f.o.b. Pierre; two 200-r.p.m. Unaflow engines for direct connection to 250-kva. alternating-current generators, f.o.b. Pierre, S. D.; 312-kva., three-phase, 60-cycle, 2400-volt, 200-r.p.m. alternating-current generators, engine type, complete with exciters, f.o.b. Pierre, S. D.; two 250-kva., three-phase, 60-cycle, 2400-volt, 200-r.p.m. alternating-current generators, engine type, complete with exciters, f.o.b. Pierre, S. D.; one seven-panel switchboard, f.o.b. Pierre, S. D.; one 35-kva. 6.6 amp. constant-current series transformer, fo.b. Pierre, S. D.; two 250-hp., 165-lb. working-pressure water-tube boilers, f.o.b. Pierre, S. D.; two 8-in. by 5-in. by 12-in. Simplex boiler-feed pumps, f.o.b. Pierre, S. D.; two 300-hp. open-type feedwater heaters f.o.b. Pierre, S. D; one condenser equipment, capacity 9000 lb. steam per hour, f.o.b. Pierre, S. D.; one triplex pump, surface type, 13 in. by 12 in., 150 lb. working pressure, f.o.b. Pierre, S. D. Bids will also be received for a chimney 125 ft. high, a brick power-plant building with concrete coal bin, a 750,000-gal. concrete reservoir, and shingle roof for old wells; also all the necessary labor, tools, material and equipment required to install all machinery equipment. Plans and specifications on file with the city auditor of Pierre, S. D., and with the engineers. Henningson Engineering Company, Omaha, Neb. J. B. Binder, Mayor; J. A. Rose, City Auditor.

KANSAS CITY, MO.—The Kansas City Light & Power Company will erect a substation at Twelfth and Bristol Avenues. A. E. Bettis, superintendent.

NOVINGER, MO.—The plant of the Merchants' Light & Power Company has recently been destroyed by fire.

O'NEIL, NEB.—The creamery plant and electric-light plant owned by the McGinnis Creamery & Produce Company was recently destroyed by fire. The loss is estimated at $40,000. Both plants will be rebuilt.

BAXTER SPRINGS, KAN.—It is under consideration that the next civic improvement in Baxter Springs shall be a municipal electric light system.

TOPEKA, KAN.—The Kansas Gas & Electric Company of Wichita has asked permission of the Public Utilities Commission to issue $475,000 of bonds. The Home Light, Heat & Power Company of Pittsburgh asked approval of a $76,000 bond issue.

Southern States

MONTICELLO, FLA.—The city is planning a bond issue for $17,500 to acquire the local electric-light and power plant. J. M. Johnson, Mayor.

BEAUMONT, TEX.—All the properties of the Stone & Webster Engineering Corporation in Beaumont and Port Arthur and the interurban electric line which connects the two places have been consolidated under the name of the Eastern Texas Electric Company, which has just been incorporated with a capital stock of $2,850,000.

MERCEDES, TEX.—In connection with the construction of the proposed precooling plants of Wetegrove & Company, to be located in the Rio Grande Valley, a quantity of equipment, including fans, ventilators and other apparatus, will be installed.

Pacific and Mountain States

EVERETT, WASH.—The City Council is considering plans for the early construction of a power station in the upper Sultana River district. Burns & McConnell, Kansas City, Mo., are engineers.

HILLYARD, WASH.—At a meeting of the City Council the matter of the city of Hillyard purchasing the poles, wires and equipment of the Washington Water Power Company in Hillyard, buying the electricity from the company and selling it to consumers in Hillyard, came up for discussion.

SEATTLE, WASH.—The Todd Dry Dock Company, 1801 Sixth Avenue, Southwest, is to erect a two-story heavy-timbered power house and storehouse to cover 100 ft. by 50 ft. and cost $9,000.

SEATTLE, WASH.—Parker & Banfield of Portland have been awarded a contract at $5,260 for constructing the generator plant at the Washington end of the Interstate bridge and work will begin at once.

SEATTLE, WASH.—The city of Seattle was authorized by the Capital Issues Committee to sell $5,500,000 in bonds for the construction of a hydroelectric plant on the Skagit River to serve war industries. A resolution was adopted authorizing the Board of Public Works to prepare plans and specifications for the Skagit work and the letting of the contract. Three units for development of hydroelectric power are available on the Skagit River, and the city has priority rights on all of them. The bond issue now authorized is designed to cover the first unit, or the Gorge Creek development, which is to furnish 35,000 kw.

SPOKANE, WASH.—Plans are being discussed for the erection of an electric furnace for the production of alloys for war purposes, on a site to be furnished by the Washington Water Power Company.

TACOMA, WASH.—Commissioner of Light and Water H. F. Gronen has been authorized to call for bids for 70,500 lb. of copper wire, for use by the lighting department. The sum of $25,000 has been appropriated.

TONASKET, WASH.—The Okanogan Valley Power Company has started construction of a new power line from Riverside to Tonasket in Okanogan County, Wash.

WENATCHEE, WASH.—A franchise has been granted to the Chelan Water Power Company for constructing a pole line from Entiat to Maple Creek.

MARSHFIELD, ORE.—The Oregon Power Company has contracted for supplying additional electric service of approximateiy 200 hp. to the local sawmills.

PORTLAND, ORE.—Parker & Banfield, contractors, were awarded a contract for constructing the generator plant at the Washington end of the interstate bridge. The contract is for $5,260.

COALINGA, CAL.—The City Council has approved a bond issue for $20,000 to provide for the construction of a municipal pumping plant. The station will be electrically operated.

FRESNO, CAL.—Plans are under consideration by the San Joaquin Light & Power Company for the construction of hydroelectric power stations on Dinkey Creek and the north branch of the King River.

LOS ANGELES, CAL.—The Public Service Department contemplates the purchasing of water rights of Big Pine Creek, in the Owens River Valley, to develop additional power. At the plant it is proposed to establish a big reservoir, cement conduits and three municipal power plants, each having a capacity of 5000 hp. making 15,000 hp. in all.

LOS ANGELES, CAL.—The Fairbanks-Morse Company is planning the installation of an electric lighting plant at Big Bear Lake Tavern, to cost about $4,500.

LOS ANGELES, CAL.—The city is planning for the construction of a new electric substation on the tidelands in Los Angeles harbor to be used for the generation of power for municipal use.

NEWPORT, CAL.—The Newport mesa district is considering plans for the erection of an electrically operated pumping plant in connection with the proposed irrigation system at Newport Beach.

OROVILLE, CAL.—A preliminary map of the proposed power development upon the middle fork of the Feather River has been completed by Paul Reicker. The plan is to construct a dam 650 ft. in height at a point in the Bald Rock Canyon. The dam will create a reservoir with a surface area of 10 sq. miles and will impound sufficient water for 2,000,000 acres.

PATTERSON, CAL.—Raymond Wyseur, superintendent of the Mineral Products Company, announced that active operations in the manufacture of magnesia pipe coverings will be started about Oct. 1 at the Patterson plant. Building operations on a boiler house, which will contain two 150-hp. boilers, and on two machinery sheds will be commenced immediately.

SALINAS, CAL.—City Engineer D. F. Davies has been authorized to purchase a quantity of 300-cp. electric lights to replace the 600-cp. electroller lights in use.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company has asked the Railroad Commission for authority to issue and sell $350,000 face value of its 6 per cent debenture bonds and $133,700 par value of preferred stock. The proceeds will be used for the purpose of financing future construction.

SANTA BARBARA, CAL.—Plans are under consideration by the City Council for the installation of a new ornamental street-lighting system on Anapamu Street.

SUSANVILLE, CAL.—Supervisor Harry E. Wood says that a movement is on foot whereby it is hoped that electric energy can be furnished to Big Valley ranchers for lighting and irrigation purposes. The plan is to install power lines from the plant at Fall River Mills to Bieber and Big Valley.

WOODLAND, CAL.—A. C. Huston, president of the Yolo Water & Power Company, has announced the completion and permanent operation of the newly installed pumping plant at Clear Lake in Lake County. The new plant has a capacity of 225,000 gal. a day.

WINNEMUCCA, NEV.—E. H. Gilman, superintendent of the Winnemucca Water & Light Company, is installing a new Pelton waterwheel at the power plant on the east side of Winnemucca. This is another improvement which is being made by the company to increase the lighting and electric power facilities of the city.

PHOENIX, ARIZ.—The municipal waterworks plant is to be equipped with three additional electric pumps.

SWANSEA, ARIZ.—Considerable electrical equipment will be installed in the new 200-ton milling plant being erected at the properties of the Swansea Mining Company.

Canada

LANGLEY, B. C.—The township of Langley recently entered into an agreement with the British Columbia Electric Railway Company, Ltd., for lighting certain of the roads and streets of the municipality, for a term of five years.

VANCOUVER, B. C.—The British Columbia Electric Company is constructing a reinforced concrete substation. The building is to be 100 ft. by 60 ft. The electrical equipment in the new station will consist of two rotary converters of 1000 kw. each and one motor-generator set of 1500 kw.

ALMONTE, ONT.—Taylor Brothers, Ltd., Toronto, have received the contract at $36,000 for a heating system for the school.

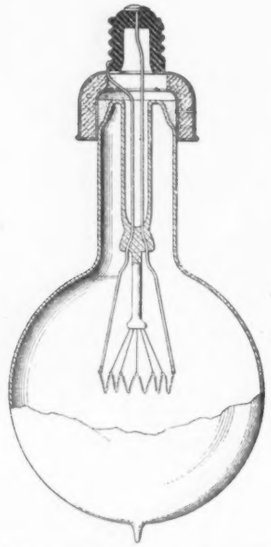
LINDSAY, ONT.—It is expected that the Hydro-Electric Company will make improvements to the lighting system on Kent Street West.

ST. JEROME, QUE.—The contract for a concrete dam for the Canadian Consolidated Rubber Company, Ltd., has been given to the Foundation Company, Ltd., Bank of Ottawa Building, Montreal.

14,493 (Reissue). SWITCH; Herbert W. Cheney, Milwaukee, Wis. App. filed Nov. 20, 1909. May be employed with safety in buildings such as textile works containing highly inflammable material.

1,271,858. ELECTRIC INCANDESCENT LAMP; John H. Dale, New York, N. Y. App. filed March 4, 1916. To lessen the transmission of the heat from the glass bulb to the lamp base by suitable heat-insulating material.

1,271,861. ELECTRIC PROTECTIVE DEVICE; William Deutscher, New York, N. Y. App. filed Dec. 20, 1912. Gives an electrically controlled warning signal when operated.



1,271,858—Electric Incandescent Lamp

1,271,863. BRUSH HOLDER FOR DYNAMO-ELECTRIC MACHINES; Charles H. J. Dilg, New York, N. Y. App. filed Jan. 7, 1913. To afford ready access to the brush for the purpose of adjustment.

1,271,873. MAGNET-OPERATED SWITCH; Rudolph C. Emmerling, John H. Wheelock and Curt J. Rohland, Worcester, Mass. App. filed April 12, 1916. Current alternations will be prevented from causing chattering of the contact points.

1,271,875. OVERLOAD CIRCUIT BREAKER; Clarence T. Evans, Milwaukee, Wis. App. filed June 28, 1917. Having few and rugged parts compactly arranged for inclosed mounting.

1,271,883. TELEPHONE SYSTEM; Clarence B. Fowler, New York, N. Y. App. filed Sept. 25, 1917. To provide "busy" testing means in which the difficulties heretofore experienced will not be encountered.

1,271,897. TELEPHONE-EXCHANGE SYSTEM; Edward E. Hinrichsen, New York, N. Y. App. filed Feb. 20, 1917. Sleeve relay associated with one end of link circuit to control intermittent operation of signaling device.

1,271,915. MACHINE FOR TRANSFORMING THE FREQUENCY OF CURRENTS; Marius C. A. Latour and Joseph Bethenod, Paris, France. App. filed Feb. 20, 1914. Apparatus for transforming polyphase currents of nf cycles into polyphase $(n+2)f$ cycles by means of a single transformation.

1,271,924. ELECTROMAGNETIC SWITCHING DEVICE; Daniel D. Miller, New York, N. Y. App. filed Nov. 27, 1916. Alternating-current electromagnetic switching device which will maintain its contacts open or closed without chattering.

1,271,933. DRY-CELL BATTERY AND METHOD OF MAKING SAME; Herbert R. Palmer, Cleveland Heights, Ohio. App. filed Oct. 16, 1917. To increase the efficiency without materially increasing the volume or weight of the cell.

1,271,980. ELECTRIC LIGHTING APPARATUS; Gilbert Wright, Schenectady, N. Y. App. filed March 11, 1914. To make the lamp conveniently accessible when mounted in a lantern.

1,271,981. SOCKET AND PLUG DEVICE; Gilbert Wright, Schenectady, N. Y. App. filed March 11, 1914. Should have watertight protection both when the connection plug is in and when it is not.

Record of Electrical Patents

Notes on United States Patents

1,271,984. COMMUTATOR AND COMMUTATOR BAR; Henry L. Zabriskie, Westfield, and Gustave C. Marx, Elizabeth, N. J. App. filed April 3, 1916. Requires a minimum number of operations for manufacture.

1,271,999. ELECTRIC CONNECTOR; John Berg, Chicago, Ill. App. filed July 30, 1917. To provide a connector whereby the circuit may be established or broken with facility.

1,272,022. TWO-WAY REPEATER CIRCUITS; Mihran M. Dolmage, Washington, D. C. App. filed Nov. 8, 1916. To prevent the so-called "singing" of the two-way repeater system.

1,272,055. ELECTRICAL SYSTEM FOR ENGINES; Charles F. Kettering and William A. Chryst, Dayton, Ohio. App. filed July 16, 1914. Engine, when operating under its own power, is used to store up energy for future starting operations.

1,272,056. IGNITION SYSTEM; Charles F. Kettering, Dayton, Ohio. App. filed Aug. 30, 1915. Adapted to be used with engines of the high-speed type.

1,272,063. ELECTRIC IRON; Moses Levinson, New York, N. Y. App. filed Nov. 2, 1917. Compact yet highly efficient ironing device, which can be folded and put away in a small receptacle.

1,272,077. ELECTRIC FURNACE; William E. Moore, Pittsburgh, Pa. App. filed Sept. 7, 1916. To expedite or shorten the time involved in melting and refining steel.

1,272,086. PROTECTIVE BOX FOR METER CONNECTIONS; Clarence D. Platt, Bridgeport, Conn. App. filed Nov. 21, 1917. Means for preventing unauthorized tampering with the meter connections.

1,272,090. CIRCUIT PROTECTIVE DEVICE; William D. Pyle, Indianapolis, Ind. App. filed July 10, 1917. The circuit will be permanently interrupted until it is manually restored.

1,272,099. SEMAPHORE SIGNAL MECHANISM; Gerret Rekers, Rochester, N. Y. App. filed April 21, 1913. The semaphore will be moved from a biased to an operated position by the operation of any well-known form of rotary motor.

1,272,126. PIN-PLUG CONNECTOR; Ralph A. Schoenberg, New York, N. Y. App. filed June 18, 1917. A pin-plug connector which is simple in construction and cheap to manufacture.

1,272,146. ELECTRIC LAMP SOCKET; George B. Thomas, Bridgeport, Conn. App. filed Feb. 8, 1913. An indicating device by means of which the position of the pull socket switch may be readily ascertained.

1,272,147. ELECTRIC SWITCH; George B. Thomas, Bridgeport, Conn. App. filed Feb. 16, 1916. To be mounted directly upon the busbars of a panelboard.

1,272,148. CHARGING OF ACCUMULATORS FROM A VARIABLE-SPEED DYNAMO-ELECTRIC MACHINE; John G. P. Thomas, Chiswick, London, England. App. filed March 23, 1914. A system by which substantially constant output is derived from a dynamo-electric machine driven at variable speed.

1,272,163. LAMP SOCKET; John W. Wiede, Baltimore, Md. App. filed June 3, 1916. A very limited movement is necessary to open and close the circuit.

1,272,166. LOADING-COIL CASE; Charles R. Young, Bloomfield, N. J. App. filed May 26, 1916. Relates particularly to construction of coil compartments therein.

1,272,167. RECHARGEABLE DRY CELL; Matthew G. Young, Geneva, Ohio. App. filed Sept. 11, 1917. Construction whereby the cell when exhausted can be readily refilled at very little expense.

1,272,184. ADVERTISING DEVICE; Wade H. Babcock, Cleveland, Ohio. App. filed May 5, 1917. Relates to that class in which a series of advertisements are successively shown and illuminated through a window.

1,272,186. MELTING FURNACE; Thaddeus F. Baily and Frank T. Cope, Alliance, Ohio. App. filed Sept. 4, 1917. Resistance troughs are located above and surround the hearth upon which the material to be melted is placed.

1,272,191. TELEGRAPH SYSTEM; John H. Bell, East Orange, N. J. App. filed July 12, 1917. To provide a telegraph transmitter capable of performing the necessary functions.

1,272,199. EXPLOSION ENGINE WITH DYNAMOMAGNETIC IGNITION; Pierre Bossu, Paris, France. App. filed Aug. 31, 1915. Method of building apparatus so as to render manufacture less cumbersome and much cheaper than hitherto.

1,272,208. COMBINATION STRAIN PLATE AND REMOVABLE TROLLEY FROG; Joseph E. Burgess, St. Louis, Mo. App. filed Aug. 1, 1914. Whereby the trolley frog can be removed and a new frog placed without disturbing the guy wires and trolley wires.

1,272,221. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Dec. 13, 1916. Signaling means whereby the work of the terminating operator is greatly simplified.

1,272,247. JAR FOR SUBMARINE AND LIKE BATTERIES; Bruce Ford, Philadelphia, Pa. App. filed April 2, 1917. To provide battery jars and their underlying supports that can be moved and installed as unitary structures.

1,272,279. CIRCUIT-INTERRUPTING DEVICE; Alben E. Lundell, New York, N. Y. App. filed Aug. 16, 1916. Interruptions will be effective even though one or more of such interrupters should be disabled.

1,272,280. TELEPHONE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed Oct. 6, 1016. A signal to an operator for indicating the designation of a calling subscriber's line.

1,272,282. TELEPHONE-EXCHANGE SYSTEM; James L. McQuarrie, Montclair, N. J. Application filed Nov. 20, 1917. Relates to automatic switches of the type used in telephone-exchange systems.

1,272,308. RAIN SIGNAL; Victor Parker, Maberry, N. C. App. filed March 21, 1917. Device which is especially adapted to give alarm if it should begin to rain.

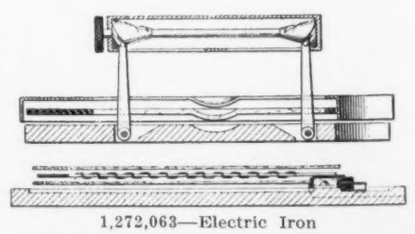
1,272,313. ARC LAMP; Edwin S. Porter, New York, N. Y. App. filed Feb. 3, 1917. Relates to projectors for moving pictures, particularly to the carbon holding and feeding means.

1,272,317. CIRCUIT CONTROLLER; Walter C. Reed, Dalton, Mass. App. filed Oct. 25, 1916. Means by which a normally closed circuit may be opened and immediately closed again; for electrically operated piano players and pipe organs.

1,272,328. SYSTEM OF ELECTRICAL DISTRIBUTION; William L. Bliss, New York, N. Y. App. filed July 2, 1904. Adapted for lighting cars or trains in which the principal source of electrical energy is a generator driven by a car axle.

1,272,332. GARMENT; Burton R. Charles, and Phyliss E. Charles, Victorville, Cal. App. filed May 29, 1917. Relates to a garment which employs a fabric having electrothermal means secured thereto.

1,272,334. ELECTRIC SPARK TIMER FOR GASOLINE ENGINES; Wilburt B. Dean, Grand Rapids, Mich. App. filed Sept. 18, 1916. To provide a spark timer that may be readily adapted to special forms and makes of engines.



1,272,063—Electric Iron

1,272,374. METHOD OF PREPARING VACUUM TUBES; Oliver Ellsworth Buckley, East Orange, N. J. App. filed Dec. 30, 1915. Heating the anode by vigorous bombardment without endangering the cathode.

1,272,397. APPARATUS FOR EFFECTING ELECTROLYSIS; Arthur Dohmen, Cologne, Germany. App. filed Dec. 1, 1914. Of the type known as "filter-press batteries."

1,272,401. ELECTRODE FOR ARC LAMPS; Henry R. Edgecomb, St. Marys, Pa. App. filed Dec. 7, 1916. A cored electrode which shall prevent the arc from migrating over the electrode.